SPECIFICATIONS

EDGEMONT UNION FREE SCHOOL DISTRICT





SED PROJECT NO.:	GREENVILLE ELEMENTARY SCHOOL	66-04-06-03-0-008-025
	SEELY ELEMENTARY SCHOOL	66-04-06-03-0-001-022
F&D PROJECT NO.:	24529.03	
OWNER:	EDGEMONT UNION FREE SCHOOL DISTRICT	
ADDRESS:	300 WHITE OAK LANE	
CITY:	SCARSDALE, NEW YORK 10583	
PROJECT NAME:	**SEELY PLACE E.S. & GREENVILLE E.S. INTERIOR RENOVATIONS & SITE IMPROVEMENTS**	

ARCHITECTS:

FULLER AND D'ANGELO, P.C.
Architects and Planners
45 Knollwood Road - Suite 401
Elmsford, NY 10523

MECHANICAL:

LANDMARK FACILITIES GROUP, INC
252 East Avenue
Norwalk, CT 06855

SITE
BARTON & LOGUIDICE
31 Sodom Road
Brewster, NY 10509

FOOD SERVICE
RAYMOND AND RAYMOND
4 St. John Street
Goshen, NY 01924

ENVIRONMENTAL
EISENBACH & RUHNKE
291 Genesee Street
Utica, NY 1350

The undersigned certifies that to the best of his knowledge, information and belief, the plans and specifications are in accordance with applicable requirements of the New York State Uniform Fire Prevention and Building Code, The State Energy Conservation and Construction Code Standards of the Department of Education.

ALTERATION OF THIS DOCUMENT EXCEPT BY A LICENSED DESIGN PROFESSIONAL, IS A VIOLATION OF NEW YORK STATE EDUCATION LAW

Date: JANUARY 14TH, 2026 – BID SUBMISSION

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APPENDIX
FOOD SERVICE EQUIPMENT CUTSHEETS

SECTION 00 0115
LIST OF DRAWING SHEETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DRAWING INDEX

A. Drawings are listed on Drawing G-1 for all contracts.

B. Drawings are the property of the Fuller and D'Angelo, Architects and Planners and shall not be used for any other purpose other than contemplated by the Drawings and Project Manual

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

SECTION 00 1113
INVITATION TO BID

SEALED PROPOSALS FOR THE:

EDGEMONT SCHOOL DISTRICT

SEELY PLACE ELEMENTARY SCHOOL AND GREENVILLE ELEMENTARY SCHOOL

INTERIOR RENOVATIONS AND SITE IMPROVEMENTS

Will Be Received By:

EDGEMONT UNION FREE SCHOOL DISTRICT

Facilities Department Office 300 White Oak Lane Scarsdale, New York , 10583

Proposals must be received on or before 11:00 AM, local time, on February 11, 2026 and must be in accordance with the requirements of the Bidding Documents to receive consideration.

Bidding Documents, including drawings and specifications, will be available beginning on

January 14, 2026.

Bidding Documents will be available at www.revplans.com or www.bidnetdirect.com

The bids will be opened and read aloud immediately following the bid receipt at the EDGEMONT

UNION FREE SCHOOL DISTRICT, Facilities Department Office, 300 White Oak Lane, Scarsdale, New York, 10583.

Proposals must be submitted on the Form provided by the Architect with all blanks appropriately filled in with the required documentation.

Bidders wishing to drop off their bid proposals may do so at the EDGEMONT UNION FREE SCHOOL DISTRICT, Facilities Department Office, 300 White Oak Lane, Scarsdale, New York, 10583. If bid proposals are shipped and/or mailed, bidders are strongly advised to ship or mail bid proposals via USPS, UPS, FedEx or any other authorized carrier able to track bidders' bid proposal package. Bids must be submitted to the Owner at the location and the address above before the hour and date of the bid opening. Bidders shall be responsible for timely delivery of their bid proposals in advance of the bid opening date. All bids received after the time stated in the Notice to Bidders will not be considered and will be returned to the bidder unopened. All bidders assume the risk of any delay in the mail, delivery or handling of the mail by employees of the Owner. Regardless of whether the bid proposal is sent by mail or by means of personal delivery, bidders assume responsibility for having bid proposals deposited on time at the place specified.

All bid prices shall be filled in, both in words and figures. Signatures shall be in ink and in longhand.

Proposals which are incomplete, conditional, or obscure may be rejected as nonresponsive to the bid specifications. Additional copies of the proposal will be furnished by the Architect upon request.

No oral or telephonic or email proposals or modifications of proposals will be considered.

Bidders shall be required to furnish, at their own expense, a bid bond in the amount of ten percent (10%) of the bid amount together with the bid. Proof of the ability to furnish a labor and material payment bond and a performance bond in the amount of 100% of the bid shall be submitted with the bid.

The Board of Education reserves the right to reject any or all bids, or portions thereof, or alternates, or alternatives; to waive any informality; and to accept such bids, or portions thereof, which, in the Board of Education's judgement is in the best interest of the School District

A non-mandatory pre-bid conference will be held on January 28, 2026 at 3:30PM. Bidders are requested to meet at the front entrance of the Greenville Elementary School located at 100 Glendale Road, Scarsdale, NY 10583. Immediately followed by a non-mandatory pre-bid conference at Seely Place Elementary School, 51 Seely Place, Scarsdale, NY 10583. All bidders are strongly encouraged to attend the pre-bid conference.

Lump Sum Bids will be received for five (5) Prime Contracts:

Contract #1 - General Construction including asbestos abatement.

Contract #2 - Plumbing

Contract #3 - HVAC

Contract #4 - Electrical

Contract #5 - Site

SECTION 00 2113
INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DOCUMENT INCLUDES

A. Bid Documents and Contract Documents

1. Definition
2. Contract Documents Identification
3. Availability
4. Examination
5. Inquiries/Addenda
6. Product/Assembly/System Substitutions

B. Site Assessment

1. Prebid Conference

C. Qualifications

1. Qualifications

D. Bid Submission

1. Bid Depository
2. Bid Ineligibility

E. Bid Enclosures/Requirements (See also Section 00 4301)

1. Security Deposit
2. Consent of Surety
3. Performance Assurance
4. Bid Form Signature
5. Additional Bid Information

F. Offer Acceptance/Rejection

1. Duration of Offer

2. Acceptance of Offer

1.3 RELATED DOCUMENTS

A. Section 01 1000 - Summary of Contracts

B. Section 00 1113 - Invitation To Bid.

C. Section 00 4100 - Bid Form Contract #1 General Construction Contractor .

D. Section 00 4110 - Bid Form Contract # 2 Plumbing Contractor

E. Section 00 4120 - Bid Form Contract #3 Mechanical

F. Section 00 4130 - Bid Form Contract # 4 Electrical Contractor

G. Section 00 4140 - Bid Form Contract #5 Site Contractor

H. Section 00 4301 - Bid Form Supplements. (All attachments)

I. Section 00 5200 - Form of Agreement.

J. Section 00 6000 - Bonds and Certificates.

K. Section 00 7200 - General Conditions.

L. Section 01 2100 - Allowances.

M. Section 01 5000 - Temporary Facilities and Controls.

N. Section 01 7000 - Execution.

O. Section 01 7800 - Closeout Submittals

1.4 BID SUBMISSION

A. Sealed bid proposals shall be signed, dated and submitted in the form required by these bid specifications to the Edgemont Union Free School District, Facilities Department Office, 300 White Oak Lane , Scarsdale, NY 10583 before **11:00** AM local time on the **11th day of February 2026** at which, time bid proposals will be publicly opened and read aloud.

B. Offers submitted after the above time will be returned to the bidder unopened.

1.5 INTENT

A. The intent of this bid solicitation is to obtain sealed bids to provide all labor and materials necessary to complete the work of the Seely Place ES & Greenville ES Interior Renovations and Site Improvements in accordance with the Contract Documents for a stipulated sum.

1.6 LUMP SUM BIDS

A. Bids will be received for five (5) separate Prime Contracts as follows:

1. General Construction , including asbestos abatement.
2. Plumbing .
3. Mechanical .
4. Electrical .
5. Site.

1.7 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

A. Work of this proposed Contract comprises site development and renovation, including related General Construction, Plumbing, HVAC, Electrical, and Site Work as reflected in each of the prime contracts.

B. Project Location:

300 White Oak Lane, Scarsdale, New York.

Scarsdale, NY 10583, NY 10583

1.8 CONTRACT TIME

A. Perform the Work within the time stated in Section 01 1000 Summary of Contract(s).

B. All work for this project shall not commence prior to the issuance of Letter of Award by the Owner. The items of work shall be scheduled and completed as stated in Section 01 1000 Summary of Contract(s). Failure to complete either date listed in Section 01 1000 Summary of Contract(s), shall subject the Contractor(s) to be assessed liquidated damages list in Article 13 of the General Conditions and any additional costs incurred by the Owner, including but not limited to, Construction Manager, Fuller and D'Angelo, P.C., Consultants, Owner's staff, overtime, and legal costs as required to complete the scheduled item.

C. The attention of the bidders is specifically directed to the provisions of the General Conditions of the Contract Article 13 of the General Conditions that time is of the essence to the Contract and that on no account will the Contactor(s) be permitted to assert a claim for damages for delays.

D. The bidder, in submitting an offer, accepts the Contract Time period stated for performing the Work. The completion date stated in the Agreement and Section 01 1000 Summary of Contract(s) .

1.9 BID DOCUMENTS AND CONTRACT DOCUMENTS

A. Definitions: All definitions set forth in the General Conditions of the Contract are applicable to these Instructions to Bidders.

B. Bid Documents: Contract Documents Instruction to Bidders, Bid Form, Supplements To Bid Forms, Bid Securities, Allowance Breakdown, and Issued Addenda.

C. Contract Documents: Defined in General Conditions.

D. Bid, Offer, or Bidding: Act of submitting an offer under seal.

E. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

1.10 AVAILABILITY

A. Bidding Documents, drawings and specifications, may be obtained online at www.recplans.com or www.bidnetdirect.com .

B. Please note **www. revplans.com** or **www.bidnetdirect.com** are the designated location and means for distributing and obtaining all bid package information. Only those Contract Documents obtained in this manner will enable a prospective bidder to be identified as an official plan holder of record. The Provider takes no responsibility for the completeness of Contract Documents obtained from other sources may not be accurate, may be incomplete may or may not contain addenda that may have been issued. Bidders assume the risk of inaccuracies in documents obtained fromany other source. Notwithstanding, bidders are responsible for all information contained in the bid specifications including addenda regardless of actual receipt.

C. All bid addenda will be transmitted to registered plan holders via email and will be available at revplans.com.or bidnet.com . Plan holders who have paid for hard copies of the bid documents will need to make the determination if hard copies of the addenda are required for their use, and coordinate directly with the printer for hard copies of addenda to be issued. There will be no charge for registered plan holders to obtain hard copies of the bid addenda.

1.11 EXAMINATION

A. Bid Documents may be viewed at the office of Fuller and D'Angelo, P.C. 45 Knollwood Road, Elmsford, NY 10523.

B. Immediately notify Architect and Construction Manager in writing of any discrepancies or omissions identified by Bidder in the Bid Documents.

C. Should any conflict occur in or between the Drawings and Specifications, the Contractor shall be deemed to have estimated on the more costly method of doing the work, unless he shall have asked for and obtained a decision in writing from the Construction Manager before the submission of his bid, as to what shall govern.

1.12 INQUIRIES/ADDENDA

A. Questions: Any and all questions about the interpretation or clarification of the Bid Documents, or about any other matter affecting the Work or pertaining to the bid must be directed in writing on the form in Section 00 2115 - RFI Form to the: Architect

1. Fuller and D'Angelo, P.C.
2. 45 Knollwood Road .
3. Elmsford, NY 10523 .
4. Attention: William Means, RA .
5. Voice: 914-592-4444
6. E-mail: WilliamM@fullerdangelo.com

B. Answers: The Architect will issue written addenda, if necessary, to answer such questions. Bidders shall rely on answers contained in such addenda and **shall not** rely upon any oral answers given by any employee or agent of the Architect, Architect's Consultants, and Construction Manager.

1. RFI's not resulting in an addendum may be issued to all plan holders at the discretion of Architect.

C. Addenda are written or graphic instruments issued prior to the Bid Date which modify or interpret the bidding documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda issued will become part of the bid documents and the resultant Contract Documents once the Construction Contract is executed

D. Written addenda may be issued during the bid process. Any addenda so issued shall become part of the bid documents. Bidders are responsible for including any resultant costs into the bid sum. All Addenda shall become part of the Contract Documents.

E. Verbal answers are not binding on any party. Any oral representations or statements made by any officer or employee of the Architect, Architect's consultants, and construction manager, or Owner shall not be binding on the Owner.

F. Clarifications requested by bidders must be in writing not less than 5 working days before date set for receipt of bids. The reply will be in the form of an Addendum, if required, a copy of which will be forwarded to known recipients/plan holders .

1.13 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS

A. Refer to Section 01 2500 - Substitution Procedures and Section 00 4301 - General Conditions Article 6.X for substitution requirements.

1.14 SITE EXAMINATION

A. The bidder shall examine and familiarize itself with the project site before submitting a bid.

B. The bidder may inspect the site at the time of the pre-bid conference, if one is scheduled, or at other times by advance agreement with the Construction Manager on an appointment basis. No inspections of the project will be permitted without pre-approval.

1. The submission of a bid shall constitute acknowledgement that the bidder has satisfied the above requirement. Bidders who do not inspect the site shall be nevertheless responsible for such information as might have been obtained from a reasonable site inspection and such failure will not relieve the bidder from any requirements and/or obligations incurred as a result of its bid.

1.15 PREBID CONFERENCE

A. A non-mandatory Pre-Bid Conference has been scheduled for 3:30 PM on **January 28, 2026.** Bidders shall meet at the front entrance of the Greenville Elementary School, located at 100 Glendale Road, Scarsdale, NY 10583. Immediately followed by a non-mandatory pre-bid conference at the Seely Place Elementary School, located at 51 Seely Place, Scarsdale, NY 10583.

B. Attendance is non mandatory. Bidder are strongly advised to attend.

C. All bidders, subcontractors and suppliers are invited.

D. Representatives of Owner, Architect, Architect's Consultants, and Construction Manager will be in attendance. Bidders must submit any questions or requests for clarification in accordance with Paragraph 1.12 of these Instructions to Bidders.

E. Summarized minutes of this meeting may be circulated to all known bidders. These minutes will not form part of the Contract Documents.

F. Information relevant to the Bid Documents will be recorded in an Addendum, issued to plan holders.

1.16 QUALIFICATIONS

A. Evidence of qualifications:

1. Bidder shall submit with their bid proposal a properly **typewritten and executed Qualification of Bidders. Refer Section 00 4301.**

B. The Owner reserves the right to require additional information it deems appropriate concerning the history of the contractor’s performance of each such contract.

C. All Prime Contractors bidding on this project must submit official certification of registration with New York State Department of Labor as required by Labor Law Section 220-i. Include Certification with this Bid package. See attachment, Section 00 4301. Note that certification will be required of all subcontractors prior to commencement of any work.

D. In accordance with the requirements of General Municipal Law §103-g, the bidder is required to include with its bid “ Iran Divestment Act Certification" Refer - Contractor’s Qualification Statement and Section 00 4301.

1.17 SUBCONTRACTORS/SUPPLIERS/OTHERS

A. Architect and Construction Manager reserves the right to reject a proposed subcontractor for reasonable cause.

B. Refer - Article 5 of the General Conditions regarding subcontractors.

1.18 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed. Bidders wishing to dropoff their bid proposals may do so at the EDGEMONT UNION FREE SCHOOL DISTRICT, Facilities Department Office, 300 White Oak Lane, Scarsdale, New York 10583. If bid proposals are shipped and/or e-mailed, bidders are strongly advised to ship or mail bid proposals via USPS, UPS, FedEx or any other authorized carrier able to track bidders bid proposal package. Bids must be submitted before the hour and date of the bid opening. Bidders shall be responsible for timely delivery of their bid proposals in advance of the bid opening date. All bids received after the time stated in the Notice to Bidders will not be considered and will be returned to the bidder. All bidders assume the risk of any delay in the mail, delivery or handling of the mail by employees of the Owner. Regardless of whether the bid proposal is sent by mail or by means of personal delivery, bidders assume responsibility for having bid proposals deposited on time at the place specified.

B. Submit two copies of the executed offer on the Bid Forms included in the project manual, signed and sealed with the required security in a closed opaque envelope, clearly identified with title of the project,

trade, name, address, and telephone number of the bidder and Edgemont Union Free School District's name clearly on the outside.

C. Improperly completed bid information, incomplete submissions, irregularities in the completion or submission of the bid and/or security deposit, may be cause for the Bid form envelope to remain unopened and the bid declared to be invalid or informal.

D. To submit a bid for a bid package, the bidder shall photo copy or remove the proposal form **from the Project Manual. Then the bidder shall complete, sign and submit the form as required therein The bidder should not submit the entire Project Manual with the bid proposal.**

E. All bid prices shall be filled in, both in words and figures. Signatures shall be in ink and in longhand. Proposals which are incomplete, conditional or obscure may be rejected.

1. In case of a discrepancy between the words and figures, **the written word, not the figures,** will govern.

2. Make no erasures, cross-outs, whiteouts, write-overs, obliteration's, or changes of any kind in the Bid Form phraseology, in the entry of unit prices, or anywhere on the Bid form. Fill in all blanks spaces legibly. An illegible entry may disqualify the bid in its entirety. If a mistake is made, use a new Bid Form. No post bid meetings will be afforded to any bidder to explain or clarify illegible or changed entries.

F. Bidder's shall not rely on oral statements made by any employee or agent of the Owner, Architect, Architect's Consultants, and Construction Manager. Before submitting a proposal, bidders shall fully inform themselves as to all existing conditions and limitations and shall include in the Proposal a sum to cover the cost of all items included in the Contract

G. No oral or telephonic proposals or modifications of proposals will be considered.

1.19 BID INELIGIBILITY

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, blanks, or irregularities of any kind, may be deemed nonresponsive.

B. Bid proposals which include bid forms, appendices, certifications and enclosures that are improperly prepared or missing may be deemed nonresponsive.

C. Failure to provide security deposit, bonding or insurance requirements or other documentation required by the bid specifications may result in the bid proposal being deemed nonresponsive.

D. Failure to provide all costs, including the cost of any base bid or total base bids will result in the bid being deemed nonresponsive.

1.20 SECURITY DEPOSIT

A. Bids shall be accompanied by a security deposit as follows:

1. Bid Bond of a sum no less than 10 percent of the Bid Amount on AIA A310 Bid Bond Form, will be required for all Proposals.

2. Refer to Section 00 6000 - Bonds and Certificates for additional requirements.

B. Endorse the Bid Bond in the name of the Edgemont Union Free School District as obligee, signed and sealed by the principal (Contractor) and surety.

C. The bid security will be returned after delivery of the required performance and labor and material payment bonds by the successful bidder to the Edgemont Union Free School District and the execution of the Owner-Contractor Agreement.

D. Include the cost of bid security in the Bid Amount.

E. After a bid has been accepted, all securities will be returned to the respective bidders .

F. If no contract is awarded, all security deposits will be returned.

1.21 CONSENT OF SURETY

A. Submit with the Bid: The attorney in fact who executes the required bonds on behalf of the surety to affix thereto an original certified and current copy of his power of attorney indicating the monetary limit of such power.

1.22 PERFORMANCE ASSURANCE

A. Accepted Bidder: Shall provide a Performance and Payment Bonds bond, as described in Section 00 6000 - Bonds and Certificates prior to the execution of the Contract, the bidder to furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in such form and amount as the Owner may prescribe and with such sureties secured through the bidder's usual sources as may be agreeable to the parties. Refer to Article 1 of the General Conditions for bond requirements.

B. Include the cost of Performance and Payment Bonds in the Bid Amount.

C. The bidder shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto an original certified and current copy of his power of attorney indicating the monetary limit of such power

1.23 INSURANCE

A. Provide an executed Insurance Coverage Certification attached as a supplement to the proposal.

B. There are special insurance requirements on this project. Refer to Article 10 of the General Conditions for a summary description of the required coverages. The Owner reserves the right to refuse the award of a Contract to any apparent low bidder who fails to provide the specified insurance certificates at the required time. Bidders must execute the enclosed Insurance Coverage Certification.

C. The Owner, Architect, Consultants, and Construction Manager shall be listed as "Additionally Insured" on all applicable policies.

D. All insurance purchased by Contractor shall constitute primary insurance and primary coverage for all risks insured and that any other liability insurance that Owner, Architect, and Construction Manager may procure or maintain is secondary and that there shall be no contribution by such insurance until insurance provided by the Contractor is exhausted.

1.24 BID FORM REQUIREMENTS

A. Complete all requested information in the Bid Form and Appendices.

1.25 SALES AND USE TAXES

A. The Owner is a tax exempt entity, therefore there shall be no charge for sales or use taxes. The Owner will document this status as requested.

1.26 FEES FOR CHANGES IN THE WORK

A. Refer to Article 8 of the General Conditions .

1.27 BID FORM SIGNATURE

A. The Bid Form shall be signed by the bidder, as follows:

1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.

2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.

3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of directors authorizing them to do so, must also be submitted with the Bid Form in the bid envelope.

4. Joint Venture: Each party of the joint venture shall execute the Bid Form under their respective seals in a manner appropriate to such party as described above, similar to the requirements of a Partnership.

1.28 EQUIVALENCY CLAUSE

A. Where, in these specifications, certain kinds, types, brands, or manufacturers of material are named, they shall be regarded as the standard of quality. Where two or less are named the Contractor may select one of those items, subject to meeting the requirements of the specified product. If the contractor desires to use any kind, type, brand, or manufacture of material other than those named in the specification, he shall indicate in writing, and fourteen days after Letter of Award, what kind, type, brand, or manufacture is requesting in lieu of the the specified items. Submit information describing in specific detail, wherein it differs from the quality and performance required by the base specifications, and such other information as may be requested by the Owner.

B. Refer to Article 6.W of the General Conditions for additional information concerning Equivalents.

C. Contractor shall refer to Form in Section 01 2500 - Substitution Procedures.

1.29 NONDISCRIMINATION

A. All Contractors and Subcontractors of all tiers and all vendors shall comply with all pertinent provisions of the State, Local and Federal law against discrimination in employment practices. Refer to Section 01 3306 - Non-Discrimination Clauses.

1.30 PREVAILING WAGES

A. New York State law requires the payment of prevailing wages on the project, as listed in Section 01 3554 - Prevailing Wage Rates.

1.31 ADDITIONAL BID INFORMATION

A. Please be sure that all supplements are included in this section and that they are accurately concurrent descibed:

1. Refer to 00 4301 - Bid Form Supplements for listing of required items and other contract attachments.

2. Section 00 6000 - Bonds and Certificates for Bid Bond, Performance and Payment Bond.

3. Section 01 2100 - Allowances.

4. Section 01 2500 - Proposed substitutions if applicable

B. Each bidder by making his bid represents that he has read and understands the bidding documents.

C. The bidder by making his bid represents that he has visited the site and familiarized himself with the local conditions under which the work is to be performed. Visits to the site shall be arranged through the Owner's Representative.

1.32 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of 45 days after the bid closing date, except as otherwise provided in General Municipal Law §103 (11).

1.33 ACCEPTANCE OF OFFER

A. The bidder acknowledges the right of the Edgemont Union Free School District to reject any or all bids and to waive any informality or irregularity in any bid received. In addition, the bidder recognizes the right of the Owner, at its discretion to reject a bid if the bidder fails to furnish any required bid security, or to submit the information required by the bidding documents, including "Qualifications of Bidders", or if the bid is incomplete or irregular.

B. The contract will be awarded to the lowest responsible bidder(s) furnishing the required security and whose bid is responsive to the bid specifications as may be determined in the best interests of the Owner.

1.34 POST-BID PROCEDURE

A. The bid proposal, allowances and information received from owners of other projects will be considered to determine whether the contractor is the "lowest responsible bidder" in making the award. The Owner, Architect and Construction Manager may make such investigation as the Owner, Architect and Construction Manager deems necessary to determine the responsibility of any bidder or to determine the ability of any bidder to perform the Work. Such investigation shall begin with a review of Qualifications of Bidder and shall include such additional information as shall be required herein.

B. The Owner, Architect, and Construction Manager reserves the right to disapprove the use of any proposed Subcontractor, and in such event, the bidder shall submit the name of another Subcontractor in like manner within the time specified by the Architect, as set forth in the Agreement.

1. To the fullest extent allowed by law, the Owner, Architect, and Construction Manager reserves the right to reject any bid if the evidence required by the Architect and Construction Manager is not submitted or fails to satisfy the Architect and Construction Manager that the bidder is responsible, able and qualified to carry out the obligations of the Owner Contract or to complete the Work as contemplated. The Construction Manager will consider the information received in determining whether or not to accept a proposal.

2. Acceptance of a proposal will be a notice in writing signed by a duly authorized representative of the Owner.

3. Any bidder whose proposal is accepted will be required to sign the Owner/Contractor Agreement no later than ten (10) days after notification of Award of Bid or five (5) days following receipt of Contract, whichever is later.

4. In the event that the Owner, Architect, and Construction Manager should reject the proposal of the bidder, the Owner may elect to meet with the next lowest bidder and to consider the information as provided above. In the event that the proposal of the next lowest bidder is rejected, the Construction Manager may elect to meet with the third lowest bidder and repeat the above process. At all times the Owner retains the right to reject all bids.

SECTION 00 2115
RFI FORM

CONTRACTOR'S REQUEST FOR INTERPRETATION NO. ____ F&D RFI NO:_____ (F&D USE)

NAME OF PROJECT: Seely Place ES & Greenville ES Interior Renovations & Site Improvements

NAME OF OWNER: Edgemont Union Free School District

FACILITY: Seely Place ES & Greenville ES

DATE: _____

A/E PROJECT NO: 24529.03

ARCHITECT: Fuller and D'Angelo, P.C.

45 Knollwood Road, Elmsford, NY 10523 Tel: 914-592-4444;

Fax: 914-592-1717

William Means, RA williamm@fullerdangelo.com

Refer to Section 00 2113 Par 1.13 for additional requirements.

FROM (CO. NAME): _____

CONTACT NAME: _____ Tel: _____

Tel: _____ E-mail: _____

SUBJECT: _____

DISCIPLINE/TRADE: _____

DWG./SPEC. REFERENCE: _____

QUESTION: _____

_____

_____

_____

___FIELD CONDITION_____

___ DRAWING/SPEC _____

___ DISCREPANCY_____

___ OWNER CHANGE_____

___ CLARIFICATION _____

___ CONTRACTOR'S SUGGESTION (IF APPLICABLE): _____

ANSWER

_____

_____

_____

_____

ARCHITECT'S SIGNATURE: _____DATE: _____

Note: review and any responses to this request for information by the architect/engineer is strictly for design intent only and does not constitute acknowledgement or acceptance of any cost or schedule implications unless specifically presented by the contractor. By submission of this request for information, the contractor assumes all responsibility in the absence of an approved change order or work directive.

SECTION 00 4100
BID FORM CONTRACT #1 GENERAL CONSTRUCTION

THE PROJECT AND THE PARTIES

TO:

Edgemont School District

300 White Oak Lane:

Scarsdale, NY 10583

FOR:

Seely Place ES & Greenville ES Interior Renovations & Site Improvements

Scarsdale, NY

DATE: _____ (Bidder to enter date)

All information must be typewritten. Handwritten Bid Form will be rejected.

SUBMITTED BY: _____

Bidder's Full Name _____

Address_____

City, State, Zip_____

Contact Individual _____

Telephone No. _____ E-mail:

_____

1.1 OFFER

A. Having examined the Place of The Work and all matters referred to in the Bidding Requirements and the Contract Documents prepared by Fuller and D'Angelo, P.C. for the Seely Place ES & Greenville ES Interior Renovations and Site Improvements, we, the undersigned, hereby offer to enter into a Contract to perform Contract No.1 General Construction Work for the Sum of:

1. **BASE BID**

   a. The Base Bid of this Proposal for all work required by the Contract Documents for Contract No.1 General Construction for the Work is as follows:

   b. _____($_____) DOLLARS

B. (The Total Base Bid is sum of 1.1.A.1.a and 1.1.A.1.b).

C. The undersigned further understands and agrees that he is to furnish and provide all the necessary material, machinery, plant, implements, tools, labor, services, skill and other items of whatever nature required, and to do and perform all the work necessary under the Contract, to complete the work in accordance with the drawings and specifications and any addenda thereto, and to accept in full compensation therefore the amount of the Total Base Bid stated, modified by such additive- or deductive alternatives, if any as are accepted by the Owner.

D. We have included the required Performance and Payment bonds **costs** in the Bid Amount.

1.2 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for forty-five (45) days from the bid closing date during which time the Owner has the right to enter into a contract, and the bid securities of the three (3) lowest responsible bidders shall be held until the executive of the Contract. Once the bid proposal has been submitted in the sealed envelope, there shall be no alterations or amendments; external markings or separate supplementary information shall, in no way, affect the sealed bid information. The contract will be awarded to the lowest responsible bidder meeting the specifications and furnishing the required security.

B. Upon award by the the Edgemont Union Free School District within the time period stated above, we will:

1. Execute the Agreement within ten (10) days of receipt of Notice of Award or five (5)days following receipt of Contract, whichever is later.

2. Furnish the required Performance and Payment bonds within ten (10) days of receipt of Notice of Award or with the executed Contract.

C. If this contract is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bonds, the security deposit shall be forfeited as damages to Edgemont Union Free School District by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.3 REJECTION OF BIDS

A. The Owner reserves the right to reject any or all proposals and to waive non-material variances in bid submissions as it deems in the best interests of the Owner.

1.4 CONTRACT TIME

A. If this Bid is accepted, we will:

1. Complete all the work covered by this Proposal with a commencement date of NO EARLIER THAN Award of Contract by Owner. Work shall be phased as indicated in 01 1000 Summary of Contract. Failure to complete each phase of work by dates indicated will result in liquidated damages as stated in the General Conditions.

1.5 CHANGES TO THE WORK

A. Refer to Article 8 of the General Conditions .

1.6 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum # _____ Dated _____.

2. Addendum # _____ Dated _____.

3. Addendum # _____ Dated _____.

4. Addendum # _____ Dated _____.

1.7 BID FORM SUPPLEMENTS

A. Refer to Section 00 4301 - Bid Form Supplements.

1.8 BIDDER'S FURTHER AFFIRMATION AND DECLARATION

A. The above name bidder and should this bid be a joint bid each party thereto, further affirm and declares:

1. That said bidder is of lawful age and the only one interested in this bid; and that no other person, firm or corporation, except those herein above named, has any interest in this bid or in the contract proposed to be entered into.

2. That this bid is made without any understanding, agreement or connection with any other person, firm, or corporation making a bid for the same work, and is in all respects fair and without collusion or fraud.

3. That said bidder is not in arrears to the Edgemont Union Free School District upon debt or contract, and is not a defaulter, as surety or otherwise upon any obligation to the said Edgemont Union Free School District

4. That no member of the Edgemont Union Free School District or any officer or employee of the Edgemont Union Free School District or person whose salary is payable in whole or in part from the Edgemont Union Free School District treasury, or the spouse of any foregoing is or shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this bid, or in the performance of the Contract, or in the supplies, materials or equipment and work or labor to which it relates, or in any portion of the profits thereof.

5. That he/she has carefully examined the site of the work and that, from his/her own investigations, he/she has satisfied him/herself as to the nature and location of the work, and character, quality and quantity of materials, and all difficulties likely to be encountered, the kind and extent of

equipment and other facilities needed for the performance of the work, the general and local conditions, and all other items which may, in any way, affect the work or its performance.

6. That if a corporation, this bid or proposal containing the Non-Collusive Binding Certification and the foregoing Affirmation and Declaration has been authorized by the Board of Directors of such Corporation, which authorization includes the signing and submission of this bid or proposal and the inclusion therein of the said Certificate of Non-Collusion and Affirmation and Declaration as the Act and Deed of the Corporation.

1.9 BID FORM SIGNATURE(S)

The Corporate Seal of

_____

(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____

(Authorized signing officer, Title)

(Seal)

_____

(Authorized signing officer, Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

Subscribed and sworn before me this day of____ 202_____

Notary Public: _____

My Commission Expire: _____

END OF BID FORM

SECTION 00 4110
BID FORM CONTRACT #2 PLUMBING

THE PROJECT AND THE PARTIES

TO:

Edgemont School District

300 White Oak Lane:

Scarsdale, NY 10583

FOR:

Seely Place ES & Greenville ES Interior Renovations & Site Improvements

Scarsdale, NY

DATE: _____ (Bidder to enter date)

All information must be typewritten. Handwritten Bid Form will be rejected.

SUBMITTED BY: _____

Bidder's Full Name _____

Address_____

City, State, Zip_____

Contact Individual _____

Telephone No. _____ E-mail:
_____

1.1 OFFER

A. Having examined the Place of The Work and all matters referred to in the Bidding Requirements and the Contract Documents prepared by Fuller and D'Angelo, P.C. for the Seely Place ES & Greenville ES Interior Renovations and Site Improvements work, we, the undersigned, hereby offer to enter into a Contract to perform Contract No. 2 Work for the Sum of:

1. **BASE BID:**

   a. The Base Bid of this Proposal for all work required by the Contract Documents for Contract No. 2 Plumbing at the Work is as follows:

   b. _____($_____)DOLLARS

B. The undersigned further understands and agrees that he is to furnish and provide all the necessary material, machinery, plant, implements, tools, labor, services, skill and other items of whatever nature required, and to do and perform all the work necessary under the Contract, to complete the work in accordance with the drawings and specifications and any addenda thereto, and to accept in full compensation therefore the amount of the Total Base Bid stated, modified by such additive- or deductive alternatives, if any as are accepted by the Owner.

C. All Allowances described in Section - 01 2100 - Allowances are included in the Total Bid Sum.

1.2 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for forty-five (45) days from the bid closing date, during which time the Owner has the right to enter into a contract, and the bid securities of the three (3) lowest responsible bidders shall be held until the execution ofthe Contract. Once the bid proposal has been submitted in the sealed envelope, there shall be no alterations or amendments; external markings or separate supplementary information shall, in no way, affect the sealed bid information. The contract will be awarded to the lowest responsible bidder meeting, the specifications and furnishing the required security.

B. Upon award by the Edgemont Union Free School District within the time period stated above, we will:

1. Execute the Agreement within ten (10) days of receipt of Notice of Award or five (5)days following receipt of Contract, whichever is later.

2. Furnish the required Performance and Payment bonds within ten (10) days of receipt of Notice of Award or with the executed Contract.

C. If this contract is awarded to us and we fail to commence the Work or we fail to provide the required Bonds, the security deposit shall be forfeited as damages to Edgemont Union Free School District by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.3 REJECTION OF BIDS

A. The Owner reservies the right to reject any or all proposals and to waive non-material variances in bid submissions as it deems in the best interests of the Owner.

1.4 CONTRACT TIME

A. If this Bid is accepted, we will:

1. Complete all the work covered by this Proposal with a commencement date of NO EARLIER THAN Award of Contract by Owner. Work shall be phased as indicated in 01 1010 Milestone Schedule. Failure to complete each phase of work by dates indicated will result in liquidated damages as stated in the General Conditions.

1.5 CHANGES TO THE WORK

A. Refer to Article 8 of the General Conditions .

1.6 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum # _____ Dated _____.

2. Addendum # _____ Dated _____.

3. Addendum # _____ Dated _____.

4. Addendum # _____ Dated _____.

1.7 BID FORM SUPPLEMENTS

A. Refer to Section 00 4301 - Bid Form Supplements.

1.8 BIDDER'S FURTHER AFFIRMATION AND DECLARATION

A. The above name bidder and should this bid be a joint bid each party thereto, further affirm and declares:

1. That said bidder is of lawful age and the only one interested in this bid; and that no other person, firm or corporation, except those herein above named, has any interest in this bid or in the contract proposed to be entered into.

2. That this bid is made without any understanding, agreement or connection with any other person, firm, or corporation making a bid for the same work, and is in all respects fair and without collusion or fraud.

3. That said bidder is not in arrears to the Edgemont Union Free School District upon debt or contract, and is not a defaulter, as surety or otherwise upon any obligation to the said Edgemont Union Free School District

4. That no member of the Edgemont Union Free School District or any officer or employee of the Edgemont Union Free School District or person whose salary is payable in whole or in part from the Edgemont Union Free School District treasury, or the spouse of any foregoing is or shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this bid, or in the performance of the Contract, or in the supplies, materials or equipment and work or labor to which it relates, or in any portion of the profits thereof.

5. That he/she has carefully examined the site of the work and that, from his/her own investigations, he/she has satisfied him/herself as to the nature and location of the work, and character, quality and quantity of materials, and all difficulties likely to be encountered, the kind and extent of equipment and other facilities needed for the performance of the work, the general and local conditions, and all other items which may, in any way, affect the work or its performance.

6. That if a corporation, this bid or proposal containing the Non-Collusive Binding Certification and the foregoing Affirmation and Declaration has been authorized by the Board of Directors of such Corporation, which authorization includes the signing and submission of this bid or proposal and

the inclusion therein of the said Certificate of Non-Collusion and Affirmation and Declaration as the Act and Deed of the Corporation.

1.9 BID FORM SIGNATURE(S)

The Corporate Seal of

_____

(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____

(Authorized signing officer, Title)

(Seal)

_____

(Authorized signing officer, Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

Subscribed and sworn before me this day of____ 202_____

Notary Public: _____

My Commission Expire: _____

END OF BID FORM

SECTION 00 4120
BID FORM CONTRACT #3 MECHANICAL

THE PROJECT AND THE PARTIES

TO:

Edgemont School District

300 White Oak Lane:

Scarsdale, NY 10583

FOR:

Seely Place ES & Greenville ES Interior Renovations & Site Improvements

Scarsdale, NY

DATE: _____ (Bidder to enter date)

All information must be typewritten. Handwritten Bid Form will be rejected.

SUBMITTED BY: _____

Bidder's Full Name _____

Address_____

City, State, Zip_____

Contact Individual _____

Telephone No. _____ E-mail:
_____

1.1 OFFER

A. Having examined the Place of The Work and all matters referred to in the Bidding Requirements and the Contract Documents prepared by Fuller and D'Angelo, P.C. for the Seely Place ES & Greenville ES Interior Renovations and Site Improvements work, we, the undersigned, hereby offer to enter into a Contract to perform Contract No. 3 Mechanical Work for the Sum of:

1. **BASE BID**

   a. The Base Bid of this Proposal for all work required by the Contract Documents for Contract No. 3 Mechanical for the Work is as follows:

   b. _____($_____) DOLLARS

   c. TOTAL ALLOWANCES

a) The Total Unit Cost Allowance as indicated in Section 01 2100 - Allowances is as follows:

d. Twenty Eight Thousand _____($28,000.00) DOLLARS

2. **TOTAL BASE BID**

a. The Total Base Bid of this Proposal for all work required by the Contract Documents for Contract No. 3 Mechanical Work is as follows:

_____ ($_____) DOLLARS

a. Note: Attach Section 01 2100 - Allowances itemized list to bid proposal.

B. The undersigned further understands and agrees that he is to furnish and provide all the necessary material, machinery, plant, implements, tools, labor, services, skill and other items of whatever nature required, and to do and perform all the work necessary under the Contract, to complete the work in accordance with the drawings and specifications and any addenda thereto, and to accept in full compensation therefore the amount of the Total Base Bid stated, modified by such additive- or deductive alternatives, if any as are accepted by the Owner.

C. All Allowances described in Section - 01 2100 - Allowances are included in the Total Bid Sum.

1.2 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for forty-five (45) days from the bid closing date during which time the Owner has the right to enter into a contract, and the bid securities of the three (3) lowest responsible bidders shall be held until the execution of the Contract. Once the bid proposal has been submitted in the sealed envelope, there shall be no alterations or amendments; external markings or separate supplementary information shall, in no way, affect the sealed bid information. The contract will be awarded to the lowest responsible bidder meeting the specifications and furnishing the required security.

B. Upon award by the Edgemont Union Free School District within the time period stated above, we will:

1. Execute the Agreement within ten (10) days of receipt of Notice of Award or five (5)days following receipt of Contract, whichever is later.

2. Furnish the required Performance and Payment bonds within ten (10) days of receipt of Notice of Award or with the executed Contract.

C. If this contract is awarded to us and we fail to commence the Work or we fail to provide the required Bonds, the security deposit shall be forfeited as damages to Edgemont Union Free School District by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.3 REJECTION OF BIDS

A. The Owner reserves the right to reject any or all proposals and to waive non-material variances in bid submissions as it deems in the best interests of the Owner.

1.4 CONTRACT TIME

A. If this Bid is accepted, we will:

1. Complete all the work covered by this Proposal with a commencement date of NO EARLIER THAN Award of Contract by Owner. Work shall be performed as indicated in 01 1000 Summary of Contract. Failure to complete each phase of work by dates indicated will result in liquidated damages as stated in the General Conditions

1.5 CHANGES TO THE WORK

A. Refer to Article 8 of the General Conditions

1.6 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum # _____ Dated _____.

2. Addendum # _____ Dated _____.

3. Addendum # _____ Dated _____.

4. Addendum # _____ Dated _____.

1.7 BID FORM SUPPLEMENTS

A. Refer to Section 00 4301 - Bid Form Supplements.

1.8 BIDDER'S FURTHER AFFIRMATION AND DECLARATION

A. The above name bidder and should this bid be a joint bid each party thereto, further affirm and declares:

1. That said bidder is of lawful age and the only one interested in this bid; and that no other person, firm or corporation, except those herein above named, has any interest in this bid or in the contract proposed to be entered into.

2. That this bid is made without any understanding, agreement or connection with any other person, firm, or corporation making a bid for the same work, and is in all respects fair and without collusion or fraud.

3. That said bidder is not in arrears to the Edgemont Union Free School District upon debt or contract, and is not a defaulter, as surety or otherwise upon any obligation to the said Edgemont Union Free School District

4. That no member of the Edgemont Union Free School District or any officer or employee of the Edgemont Union Free School District or person whose salary is payable in whole or in part from the Edgemont Union Free School District treasury, or the spouse of any foregoing is or shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this bid, or in the performance of the Contract, or in the supplies, materials or equipment and work or labor to which it relates, or in any portion of the profits thereof.

5. That he/she has carefully examined the site of the work and that, from his/her own investigations, he/she has satisfied him/herself as to the nature and location of the work, and character, quality and quantity of materials, and all difficulties likely to be encountered, the kind and extent of equipment and other facilities needed for the performance of the work, the general and local conditions, and all other items which may, in any way, affect the work or its performance.

6. That if a corporation, this bid or proposal containing the Non-Collusive Binding Certification and the foregoing Affirmation and Declaration has been authorized by the Board of Directors of such Corporation, which authorization includes the signing and submission of this bid or proposal and the inclusion therein of the said Certificate of Non-Collusion and Affirmation and Declaration as the Act and Deed of the Corporation.

1.9 BID FORM SIGNATURE(S)

The Corporate Seal of

_____

(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____

(Authorized signing officer, Title)

(Seal)

_____

(Authorized signing officer, Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

Subscribed and sworn before me this day of____ 202____

Notary Public: _____

My Commission Expire: _____

END OF BID FORM

SECTION 00 4130
BID FORM CONTRACT #4 ELECTRICAL

THE PROJECT AND THE PARTIES

TO:

Edgemont School District

300 White Oak Lane:

Scarsdale, NY 10583

FOR:

Seely Place ES & Greenville ES Interior Renovations & Site Improvements

Scarsdale, NY

DATE: _____ (Bidder to enter date)

All information must be typewritten. Handwritten Bid Form will be rejected.

SUBMITTED BY: _____

Bidder's Full Name _____

Address_____

City, State, Zip_____

Contact Individual _____

Telephone No. _____ E-mail:
_____

1.1 OFFER

A. Having examined the Place of The Work and all matters referred to in the Bidding Requirements and the Contract Documents prepared by Fuller and D'Angelo, P.C. for Seely Place ES & Greenville ES Interior Renovations and Site Improvements, we, the undersigned, hereby offer to enter into a Contract to perform Contract No. 4 Electrical Work for the Sum of:

1. **BASE BID**

a. The Base Bid of this Proposal for all work required by the Contract Documents for Contract No. 4 Electrical Work is as follows:

_____$_____ DOLLARS

B. The undersigned further understands and agrees that he is to furnish and provide all the necessary material, machinery, plant, implements, tools, labor, services, skill and other items of whatever nature required, and to do and perform all the work necessary under the Contract, to complete the work in accordance with the drawings and specifications and any addenda thereto, and to accept in full compensation therefore the amount of the Total Base Bid stated, modified by such additive- or deductive alternatives, if any as are accepted by the Owner.

C. All Allowances described in Section - 01 2100 - Allowances are included in the Total Bid Sum.

1.2 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for forty-five (45) days from the bid closing date during which time the Owner has the right to enter into a contract, and the bid securities of the three (3) lowest responsible bidders shall be held until the execution of the Contract. Once the bid proposal has been submitted in the sealed envelope, there shall be no alterations or amendments; external markings or separate supplementary information shall, in no way, affect the sealed bid information. The contract will be awarded to the lowest responsible bidder meeting the specifications and furnishing the required security.

B. Upon award by the Edgemont Union Free School District within the time period stated above, we will:

1. Execute the Agreement within ten (10) days of receipt of Notice of Award or five (5)days following receipt of Contract, whichever is later.

2. Furnish the required Performance and Payment bonds within ten (10) days of receipt of Notice of Award or with the executed Contract.

C. If this contract is awarded to us and we fail to commence the Work or we fail to provide the required Bonds, the security deposit shall be forfeited as damages to Edgemont Union Free School District by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.3 REJECTION OF BIDS

A. The Owner reserves the right to reject any or all proposals and to waive non-material variances in bid submissions as it deems in the best interests of the Owner.

1.4 CONTRACT TIME

A. If this Bid is accepted, we will:

1. Complete all the work covered by this Proposal with a commencement date of NO EARLIER THAN Award of Contract by Owner. Work shall be phased as indicated in 01 1000 Summary of Contract. Failure to complete each phase of work by dates indicated will result in liquidated damages as stated in the General Conditions.

1.5 CHANGES TO THE WORK

A. Refer to Article 8 of the General Conditions.

1.6 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum # _____ Dated _____.

2. Addendum # _____ Dated _____.

3. Addendum # _____ Dated _____.

4. Addendum # _____ Dated _____.

1.7 BID FORM SUPPLEMENTS

A. Section 00 4301 - Bid Form Supplements.

1.8 BIDDER'S FURTHER AFFIRMATION AND DECLARATION

A. The above name bidder and should this bid be a joint bid each party thereto, further affirm and declares:

1. That said bidder is of lawful age and the only one interested in this bid; and that no other person, firm or corporation, except those herein above named, has any interest in this bid or in the contract proposed to be entered into.

2. That this bid is made without any understanding, agreement or connection with any other person, firm, or corporation making a bid for the same work, and is in all respects fair and without collusion or fraud.

3. That said bidder is not in arrears to the Edgemont Union Free School District upon debt or contract, and is not a defaulter, as surety or otherwise upon any obligation to the said Edgemont Union Free School District

4. That no member of the Edgemont Union Free School District or any officer or employee of the Edgemont Union Free School District or person whose salary is payable in whole or in part from the Edgemont Union Free School District treasury, or the spouse of any foregoing is or shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this bid, or in the performance of the Contract, or in the supplies, materials or equipment and work or labor to which it relates, or in any portion of the profits thereof.

5. That he/she has carefully examined the site of the work and that, from his/her own investigations, he/she has satisfied him/herself as to the nature and location of the work, and character, quality and quantity of materials, and all difficulties likely to be encountered, the kind and extent of equipment and other facilities needed for the performance of the work, the general and local conditions, and all other items which may, in any way, affect the work or its performance.

6. That if a corporation, this bid or proposal containing the Non-Collusive Binding Certification and the foregoing Affirmation and Declaration has been authorized by the Board of Directors of such

Corporation, which authorization includes the signing and submission of this bid or proposal and the inclusion therein of the said Certificate of Non-Collusion and Affirmation and Declaration as the Act and Deed of the Corporation.

1.9 BID FORM SIGNATURE(S)

The Corporate Seal of

_____

(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____

(Authorized signing officer, Title)

(Seal)

_____

(Authorized signing officer, Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

Subscribed and sworn before me this day of____ 202_____

Notary Public: _____

My Commission Expire: _____

END OF BID FORM

SECTION 00 4140
BID FORM CONTRACT #5 SITE

THE PROJECT AND THE PARTIES

TO:

Edgemont School District

300 White Oak Lane:

Scarsdale, NY 10583

FOR:

Seely Place ES & Greenville ES Interior Renovations & Site Improvements

Scarsdale, NY

DATE: _____ (Bidder to enter date)

All information must be typewritten. Handwritten Bid Form will be rejected.

SUBMITTED BY: _____

Bidder's Full Name _____

Address_____

City, State, Zip_____

Contact Individual _____

Telephone No. _____ E-mail:
_____

1.1 OFFER

A. Having examined the Place of The Work and all matters referred to in the Bidding Requirements and the Contract Documents prepared by Fuller and D'Angelo, P.C. for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform Contract No. 5 Site Work for the Sum of:

1. **BASE BID**

a. The Base Bid of this Proposal for all work required by the Contract Documents for Contract No. 5 Site at the Seely Place Elementary School and Greenville Elementary School is as follows:

b. _____($_____) DOLLARS

c. TOTAL ALLOWANCES

a) The Total Allowance as indicated in Section 01 2100 - Allowances is as follows:

d. _____($_____) DOLLARS

e. **Note: Attach Section 01 2100 - Allowances itemized contingency list to bid proposal.**

f. **TOTAL BASE BID**

a) The Total Base Bid of this Proposal for all work required by the Contract Documents for Contract No. 5 Site and Related Work work at the Seely Place Elementary School and Greenville Elementary School is as follows:

g. _____($_____) DOLLARS

B. The undersigned further understands and agrees that he is to furnish and provide all the necessary material, machinery, plant, implements, tools, labor, services, skill and other items of whatever nature required, and to do and perform all the work necessary under the Contract, to complete the work in accordance with the drawings and specifications and any addenda thereto, and to accept in full compensation therefore the amount of the Total Base Bid stated, modified by such additive- or deductive alternatives, if any as are accepted by the Owner.

C. We have included the required security Bid Bond.

D. All applicable federal taxes and NY taxes are included in the Total Bid Sum.

E. All Allowances described in Section - 01 2100 - Allowances are included in the Total Bid Sum.

1.2 ACCEPTANCE

A. This offer shall be open to acceptance and is irrevocable for forty-five (45) days from the bid closing date.

B. If this bid is accepted by Edgemont Union Free School District within the time period stated above, we will:

1. Execute the Agreement within ten (10) days of receipt of Notice of Award or five (5)days following receipt of Contract, whichever is later.

2. Furnish the required Performance and Payment bonds within ten (10) days of receipt of Notice of Award or with the executed Contract.

C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bonds, the security deposit shall be forfeited as damages to Edgemont Union Free School District by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.3 REJECTION OF BIDS

A. The undersigned agrees that the Owner shall have the right to accept or reject any or all bids.

1.4 CONTRACT TIME

A. If this Bid is accepted, we will:

1. Complete all the work covered by this Proposal with a commencement date of NO EARLIER THAN Award of Contract by Owner. Work shall be phased as indicated in 01 1000 Summary of Contract. Failure to complete each phase of work by dates indicated will result in liquidated damages as stated in the General Conditions.

1.5 CHANGES TO THE WORK

A. Refer to General Conditions Article 8.

1.6 ADDENDA

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum # _____ Dated _____.
2. Addendum # _____ Dated _____.
3. Addendum # _____ Dated _____.
4. Addendum # _____ Dated _____.

1.7 BID FORM SUPPLEMENTS

A. Refer to Section 00 4301 - Bid Form Supplements.

1.8 NON-COLLUSIVE BIDDING CERTIFICATION

A. By submission of this bid or proposal:

1. The undersigned bidder and the person or persons signing on behalf of the bidder, and should this bid be a joint bid, each party thereto, certifies as to its own organization, under penalty of perjury, that to the best of his/her knowledge and belief:

a. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor.

b. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor.

c. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

1.9 BIDDER'S FURTHER AFFIRMATION AND DECLARATION

A. The above name bidder and should this bid be a joint bid each party thereto, further affirm and declares:

1. That said bidder is of lawful age and the only one interested in this bid; and that no other person, firm or corporation, except those herein above named, has any interest in this bid or in the contract proposed to be entered into.

2. That this bid is made without any understanding, agreement or connection with any other person, firm, or corporation making a bid for the same work, and is in all respects fair and without collusion or fraud.

3. That said bidder is not in arrears to the Edgemont Union Free School District upon debt or contract, and is not a defaulter, as surety or otherwise upon any obligation to the said Edgemont Union Free School District

4. That no member of the Edgemont Union Free School District or any officer or employee of the Edgemont Union Free School District or person whose salary is payable in whole or in part from the Edgemont Union Free School District treasury, or the spouse of any foregoing is or shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this bid, or in the performance of the Contract, or in the supplies, materials or equipment and work or labor to which it relates, or in any portion of the profits thereof.

5. That he/she has carefully examined the site of the work and that, from his/her own investigations, he/she has satisfied him/herself as to the nature and location of the work, and character, quality and quantity of materials, and all difficulties likely to be encountered, the kind and extent of equipment and other facilities needed for the performance of the work, the general and local conditions, and all other items which may, in any way, affect the work or its performance.

6. That if a corporation, this bid or proposal containing the Non-Collusive Binding Certification and the foregoing Affirmation and Declaration has been authorized by the Board of Directors of such Corporation, which authorization includes the signing and submission of this bid or proposal and the inclusion therein of the said Certificate of Non-Collusion and Affirmation and Declaration as the Act and Deed of the Corporation.

1.10 BID FORM SIGNATURE(S)

The Corporate Seal of

_____

(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

_____

(Authorized signing officer, Title)

(Seal)

_____

(Authorized signing officer, Title)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

Subscribed and sworn before me this day of____ 20_____

Notary Public: _____

My Commission Expire: _____

END OF BID FORM

SECTION 00 4301
BID FORM SUPPLEMENTS

PARTICULARS

TO: **Edgemont Union Free School District**

Architect's Project Number **24529.03**

Project Description: **Seely Place ES & Greenville ES Interior Renovations & Site Improvements**

Date: _____

Please type form.

Submitted By: (Bidder to insert full name and address)

_____

_____

_____

Tel: _____E-Mail: _____

A. In accordance with Section 00 2113 - Instructions to Bidders and Bid Form - we include the Supplements To Bid Form items listed below. The information provided shall be considered an integral part of the Bid Form.

B. Each of the following documents **must be included** in the Bidder's Bid package and must be completed , signed and notarized where indicated. The Owner reserves the right to reject as nonresponsive any bid submission that does not contain all required documents.

1.1 SUPPLEMENTS TO BID FORM

A. Section - 00 4100, 00 4110, 00 4120, or Section 00 4130 - Bid Form. (submit per contract being bid)

B. Security- Bid Bond or Certified Check. See Section 00 6000

C. Section 01 2100 - Allowances

D. Section 00 4301 - Bid Form Supplements. The following Forms and Certifications attached are part of this Section:

1. Insurance Coverage Certification
2. Form of Disclosure
3. Hold Harmless Agreement
4. Certification of Compliance with Iran Divestment Act
5. Declaration of Bidders Inability to Provide Certification of Compliance with Iran Divestment Act

6. Labor Law 220-I Certification Form

7. Non-Collusive Form

8. Qualifications of Bidders

9. Statement of Bidders Qualifications

10. Sexual Harassment Prevention Certificate

INSURANCE COVERAGE CERTIFICATION

_____ (name), President/CEO/Owner/Managing Member of _____ (bidder), hereby represents that the bidder currently has, or immediately upon being awarded the contract, will obtain insurance coverage, from an insurer licensed and admitted to do business in the State of New York, that meets the following requirements:

1. **Workers' Compensation, Paid Family Leave and NYS Disability Insurance**
   Statutory Workers' Compensation (C-105.2 or U-26.3), NYS Paid Leave and NYS Disability Insurance (DB-120.1) for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable. A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

2. **Commercial General Liability Insurance**
   $1,000,000 per Occurrence/$2,000,000
   $2,000,000 Products and Completed Operations
   $1,000,000 Personal and Advertising Injury
   $100,000 Fire Damage
   $10,000 Medical Expense
   The general aggregate shall apply on a per-project basis.

3. **Owners Contractors Protective (OCP) Insurance**:
   For Projects less than or equal to $1,000,000 and work on 1 story (10 feet) only: $1,000,000 per occurrence, $2,000,000 aggregate with the Owner as the named insured.

   For Projects greater than $1,000,000 and/or work above one story (10 feet): $2,000,000 per occurrence, $4,000,000 aggregate with the Owner as the named insured.

   The Owner will be the named insured on OCP Policies. There will be no additional insureds on any OCP Policies.

4. **Automobile Liability**
   $1,000,000 combined single limit for owned, hired, borrowed and non-owned motor vehicles.

5. **Umbrella/Excess Insurance**
   $5,000,000 each occurrence and aggregate for general construction (including plumbing, electrical and HVAC) and no work at elevation (1 story or 10 feet) or Project values less than or equal to $1,000,000.

$10,000,000 each occurrence and aggregate for high-risk construction, work at elevation (>1 story or 10 feet) or Project values greater than $1,000,000.

Umbrella/Excess coverage shall be on a follow-form basis or provide broader coverage over the General Liability and Automobile Liability coverages.

6. **Asbestos/Lead Abatement/Pollution Liability Insurance**
If the Project requires the removal of asbestos and/or hazardous materials, Contractor shall provide hazardous material liability insurance as follows:

$2,000,000 per occurrence/$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement, enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. If a retroactive date is used, it shall pre-date the inception of the Contract.

If the Contractor is using motor vehicles for transporting hazardous materials, the Contractor shall provide pollution liability broadened coverage (ISO endorsement CA 9948 or CA 01 12), as well as proof of MCS 90. Coverage shall fulfill all requirements of this Article 10 and shall extend for a period of three (3) years following acceptance by the Owner of the Certificate of Completion.

7. **Testing Company Errors and Omission Insurance**
$1,000,000 per occurrence/$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the Owner.

Insurance Representative's Acknowledgment:

We have reviewed the insurance requirements set forth in the Bidding Documents and are capable of providing such insurance to our insured in accordance with such requirements in the event the contract is awarded to our insured and provided our insured pays the appropriate premium.

Insurance Representative: _____

Address: _____

_____

Are you an agent for the companies providing the coverage: Yes _____ No _____

Date: _____ _____

Insurance Representative

Bidder's Acknowledgment:

I acknowledge that I have reviewed the insurance requirements for this bid and have considered the costs, if any, of procuring the required insurance and will be able to supply the insurance required in accordance with the bid, if it is awarded. I understand that a certificate of insurance must be submitted with my bid; and if it is not, the Owner may reject my bid and award to the next lowest bidder.

Firm Name: _____

Address: _____

_____

Date: _____ _____

Bidder's Signature

-FORM OF DISCLOSURE-

THE UNDERSIGNED AFFIRMS THAT THE FOLLOWING CONSTITUTE ALL OFFICERS, DIRECTORS, PARTNERS, OR CONTROLLING PRINCIPALS OF THE FIRM:

Name	Title
_____	_____
_____	_____

1. Does any School District Board Member, administrator, or employee possess any financial interest, directly or indirectly, in the firm?_____ If yes, set forth the basis upon which a financial interest exists in the firm:

   _____

   _____

2. Has the firm or any of its officers, directors, partners, or controlling principals possessed any interest in transactions heretofore entered into with the School District?_____ If yes, please describe transaction(s):

   _____

   _____

3. Does any direct relative of a member of the Board, administrators, or staff possess any financial interest, directly or indirectly, in the firm (For purpose of this inquiry a direct relative is to be defined as a parent, spouse, child or sibling)._____If yes, set forth below the School District Board Member, administrator, or staff member whose relation possess an interest and the relationship:

   _____

   _____

THE UNDERSIGNED AFFIRMS THAT THE ABOVE STATEMENTS ARE TRUE AND UNDERSTANDS THAT ANY FALSE STATEMENT SHALL CONSTITUTE A VIOLATION OF THE PENAL CODE OR GENERAL MUNICIPAL LAW AS APPLICABLE.

Firm: _____

Signature: _____

Print Name: _____

Title: _____

Date: _____

HOLD HARMLESS AGREEMENT

In accordance with Article 12 of the General Conditions ("Indemnification"), the Contractor agrees as follows to the following indemnification obligations under its Agreement with the Owner:

A. The Contractor and its SubContractors shall defend, indemnify, and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges, and expenses, including but not limited to attorney's fees, which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such contractor or any of its subcontractors or any person or firm directly or indirectly employed by such contractor, for the act(s) and/or omission(s) of any contractor or subcontractor in connection with the work of the Project.

B. To the fullest extent permitted by law, the Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of its work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction, of tangible property including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a SubContractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph B. The Contractor's indemnity obligations under this Paragraph B shall, but not by way of limitation, specifically include all claims and judgments which may be made against the Owner, the Architect, the Architect's consultants and agents and employees of any of them under any applicable statute, rule or regulation including the New York Statute, Occupational Safety and Hazardous Act, and the Federal Occupational Safety and Hazardous Act. In claims against any person or entity indemnified under this Paragraph B by an employee of the Contractor, a SubContractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Paragraph B shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a SubContractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and its agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers and agents from and against any fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder which are incurred as a result of the Contractor's failure to give the notices required by Article 6(T) of these General Conditions of the Contract for Construction.

D. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2)

the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any actions, lawsuits, or proceedings or claims of liens brought against each or any of them as a result of liens filed against the Contractor's Project funds, including all the cost and expense of said liens, and including but not limited to attorney's fees incurred by each or any of them.

E. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any and all liability for violation of all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies applicable to the Contractor's work and shall defend any claims or actions which may be brought against the Owner as the result thereof.

F. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any and all liability for claims made by third parties, including SubContractors, in connection with this Agreement and shall defend any claims or actions which may be brought against the Owner as the result thereof.

G. The Contractor shall indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges, and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such contractor or any subcontractor or any person or firm directly or indirectly or indirectly employed by such contractor, with respect to violations of OSHA requirements, rules, and/or regulations.

H. The indemnification obligations set forth herein shall become effective upon the Owner, the Architect or the Construction Manager's receipt of a claim for which the Contractor is required to provide indemnification to the Owner, the Architect, or the Construction Manager. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor. In the event the Owner, the Architect, or the Construction Manager is required to bring an action to enforce the indemnification obligations set forth herein, the Contractor shall be liable to the Owner, the Architect, and/or the Construction Manager for all costs associated with said action including attorney's fees.

By: _____

Signature of Authorized Representative of Contractor

_____

(Print Name and Title)

_____

(Date)

CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT

As a result of the Iran Divestment Act of 2012 (the "Act"), Chapter 1 of the 2012 Laws of New York, a new provision has been added to State Finance Law (SFL) § 165-a and New York General Municipal Law § 103-g, both effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list of "persons" who are engaged in "investment activities in Iran" (both are defined terms in the law) (the "Prohibited Entities List"). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act's effective date at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, each Bidder/Contractor, any person signing on behalf of any Bidder/Contractor and any assignee or subcontractor and, in the case of a joint bid, each party thereto, certifies, under penalty of perjury, that once the Prohibited Entities List is posted on the OGS website, that to the best of its knowledge and belief, that each Bidder/Contractor and any subcontractor or assignee is not identified on the Prohibited Entities List created pursuant to SFL § 165-a(3)(b).

Additionally, Bidder/Contractor is advised that once the Prohibited Entities List is posted on the OGS Website, any Bidder/Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to this solicitation must certify at the time the Contract is renewed, extended or assigned that it is not included on the Prohibited Entities List.

During the term of the Contract, should the School District receive information that a Bidder/Contractor is in violation of the above-referenced certification, the School District will offer the person or entity an opportunity to respond. If the person or entity fails to demonstrate that he/she/it has ceased engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then the School District shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages or declaring the Bidder/Contractor in default. The School District reserves the right to reject any bid or request for assignment for a Bidder/Contractor that appears on the Prohibited Entities List prior to the award of a contract and to pursue a responsibility review with respect to any Bidder/Contractor that is awarded a contract and subsequently appears on the Prohibited Entities List.

I, _____, being duly sworn, deposes and says that he/she is the

_____ of the _____ Corporation and that neither the

Bidder/ Contractor nor any proposed subcontractor is identified on the Prohibited Entities List.

_____

SIGNED

SWORN to before me this

_____ day of _____

20___

Notary Public: _____

DECLARATION OF BIDDER'S INABILITY TO PROVIDE CERTIFICATION OF COMPLIANCE WITH THE IRAN DIVESTMENT ACT

Bidders shall complete this form if they cannot certify that the bidder /contractor or any proposed subcontractor is not identified on the Prohibited Entities List. The District reserves the right to undertake any investigation into the information provided herein or to request additional information from the bidder.

Name of the Bidder: _____

Address of Bidder: _____

Has bidder been involved in investment activities in Iran? _____
Describe the type of activities including but not limited to the amounts and the nature of the investments (*e.g.* banking, energy, real estate)_____
_____
_____
_____

If so, when did the first investment activity occur? _____

Have the investment activities ended? _____

If so, what was the date of the last investment activity?_____

If not, have the investment activities increased or expanded since April 12, 2012? _____

Has the bidder adopted, publicized, or implemented a formal plan to cease the investment activities in Iran and to refrain from engaging in any new investments in Iran?_____

If so, provide the date of the adoption of the plan by the bidder and proof of the adopted resolution, if any and a copy of the formal plan. _____

In detail, state the reasons why the bidder cannot provide the Certification of Compliance with the Iran Divestment Act below (additional pages may be attached):
_____
_____
_____
_____
_____
_____

I, _____ being duly sworn, deposes and says that he/she is the _____ of

the _____ Corporation and the foregoing is true and accurate.

_____
SIGNED

SWORN to before me this

_____ day of _____

20___
Notary Public: _____

Labor Law 220-i Certification Form

By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that: the bidder has registered with the New York State Department of Labor pursuant to Section 220-I of the Labor Law and that each of the subcontractors to be used on the project has similarly registered and has attached confirmation of said registration to its bid.

Bidder Name: _____

Bidder Address: _____

Print Name and Title: _____

Signature: _____

Date: _____

Sworn to before me this _____
day of _____, 20____

_____
Notary Public

NON-COLLUSIVE FORM
BID PROPOSAL CERTIFICATIONS

Firm Name _____

Business Address _____

Telephone Number _____ Date of Bid _____

I. General Bid Certification

The bidder certifies that he will furnish, at the prices quoted, the materials, equipment and/or services as proposed on this Bid.

II. Non-Collusive Bidding Certification

The following statement is made pursuant to Section 103-D of the General Municipal Law, as amended by Chapter 675 of the Laws of 1966, and Section 139-D of the State Finance Law, as amended by Chapter 675 of the Laws of 1966, and Section 2604 of the Public Authorities Law, as amended by Chapter 675 of the Laws of 1966.

By submission of this bid proposal, the bidder certifies that he/she is complying with Section 103-d of the General Municipal Law as follows:

Statement of non-collusion in bids and proposals to political subdivision of the state. Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation, or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury:

Non-collusive bidding certification.

(a) By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief:

1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be

disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and,

3. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

(b) A bid shall not be considered for award nor shall any award be made where (a) (1) (2) and (3) above have not been complied with; provided, however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the reasons therefor. Where (a) (1) (2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department agency or official thereof to which the bid is made or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph one (a).

Any bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certifications referred to in subdivision II of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing, and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of corporation.

The bidder affirms the above statement as true under the penalties of perjury.

Signature of Bidder: _____
(Signature of bidder or authorized representative of a corporation)

Title: _____

Sworn to before me this _____ day
of _____, 20____

_____
Notary Public

QUALIFICATIONS OF BIDDERS

Experience and Qualifications of the Bidder: Each bidder is required to submit the following documentation to demonstrate its experience and qualifications for the work of the Project for which a bid is submitted:

a. A description of its experience with projects of comparative size, complexity, and cost, together with documentary evidence showing that said projects were completed to the Owner's satisfaction and were completed in a timely fashion;

b. Documentation from each of the projects it has performed capital work in the last five (5) years concerning the bidder's:

   i. timeliness of performance of the work of the project

   ii. evidence that the project was completed to the Owner's satisfaction;

   iii. whether or not any extensions of time were requested by the contractor and whether or not such requests were granted;

   iv. whether litigation and/or arbitration was commenced by either the Owner or the bidder as a result of the work of the project performed by the bidder;

   v. whether any liens were filed on the project by subcontractors or material suppliers of the bidder;

   vi. whether the bidder was defaulted on the project by the owner;

   vii. whether the bidder made any claims for extra work on the project, including whether said claim resulted in a change order;

c. Documentation evidencing the bidder's financial responsibility, including a certified financial statement prepared by a certified public accountant.

d. Documentation evidencing the bidder's existence under the same name for the last five (5) years.

e. Documentation evidencing the bidder's Worker's Compensation Experience Modification.

STATEMENT OF BIDDER'S QUALIFICATIONS

IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE ANSWER TO ALL OF THE QUESTIONS IN THIS STATEMENT. IF ADDITIONAL SPACE IS REQUIRED TO FURNISH A COMPLETE ANSWER, BIDDER MAY ATTACH PAGES AS NECESSARY. IN THE EVENT THAT COMPLETE ANSWERS ARE NOT PROVIDED TO EVERY QUESTION, THE BID WILL BE REJECTED.

1. Name of Bidder

_____

2. Type of Business Entity

_____

3. If the bidder is a corporation, state the date and place of incorporation of the corporation.

_____

4. For how many years has the bidder done business under its present name?

_____

5. List the persons who are directors, officers, owners, managerial employees, or partners in the bidder's business.

_____

_____

_____

_____

_____

6. Have any of the persons listed in Number 5 owned/operated/been shareholders in any other companies? If so, please state the names of the other companies and the individuals who owned, operated, or have been shareholders:

_____

_____

_____

7. Has any director, officer, owner, or managerial employee had any professional license suspended or revoked? If the answer to this question is yes, list the name of the individual, the professional license he/she formerly held, whether said license was revoked or suspended and the date of the revocation or suspension.

8. Has the bidder been found guilty of any OSHA Violations? If the answer to this question is yes, describe the nature of the OSHA violation, an explanation of remediation or other steps taken regarding such violation(s).

9. Has the bidder been charged with any claims pertaining to unlawful intimidation or discrimination against any employee by reason of age, race, creed, color, national origin, citizenship or immigration status, sexual orientation, gender identity or expression, military status, sex, disability, predisposing genetic characteristics, familial status, or status as a victim of domestic violence, and/or violations of an employee's civil rights or equal employment opportunities? If the answer to this question is yes, list the persons making such claim against the bidder, a description of the claim, the status of the claim, and what disposition (if any) has been made regarding such claim.

10. Has the bidder been named as a party in any lawsuit arising from performance of work related to any project in which it has been engaged? If the answer to this question is yes, list all such lawsuits, the index number associated with said suit and the status of the lawsuit at the time of the submission of this bid.

11. Has the bidder been the subject of an investigation and/or proceedings before the Department of Labor for alleged violations of the Labor Law as it relates to the payment of prevailing wages and/or supplemental payment requirements? If the answer to this question is yes, please list each such instance of the commencement of a Department of Labor proceeding, for which project such proceeding was commenced, and the status of the proceeding at the time of the submission of this bid.

12. Has the bidder been the subject of an investigation and/or proceeding before any law enforcement agency, including, but not limited to any District Attorney's Office? If the answer to this question is yes, please list each such instance, the law enforcement agency, the nature of the proceeding, the project for which such proceeding was commenced, if applicable to a project, and the status of the proceeding at the time of the submission of this bid.

13. Has the bidder been the subject of proceedings involving allegations that it violated the Workers' Compensation Law, including but not limited to, the failure to provide proof of worker's compensation or disability coverage and/or any lapses thereof? If the answer to this question is yes, list each such instance of violation and the status of the claimed violation at the time of the submissions of this bid.

14. Has the bidder, its officers, directors, owner and/or managerial employees been convicted of a crime or been the subject of a criminal indictment? If the answer to this question is yes, list the name of the individual convicted or indicted, the charge against the individual and the date of disposition of the charge.

15. Has the bidder been charged with and/or found guilty of any violations of federal, state, or municipal environmental and/or health laws, codes, rules and/or regulations? If the answer to this question is yes, list the nature of the charge against the bidder, the date of the charge, and the status of the charge at the time of the submission of this bid.

16. Has the bidder bid on any projects in the last five years preceding the date of this bid submission? If the answer to this question is yes, list the projects bid on, whether said bid was awarded to the bidder and the expected date of commencement of the work for said project. For those projects listed, if the bidder was not awarded the contract, state whether the bidder was the lowest monetary bidder.

IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #16 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

17. Does the bidder have any projects ongoing at the time of the submission of this bid? If the answer to this question is yes, list the projects on which the bidder is currently working, and the expected date of completion of said project.

IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #17 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

18. Have the bidder and its bond surety ever been notified by a project Owner that the Owner is contemplating declaring a default and requested a conference to discuss the performance of the contract? If the answer to this question is yes, list the projects on which such a conference was held, and the result of the conference, and the status of the project in question.

19. Has the bidder ever been terminated from a Project by the Owner? If the answer to this question is yes, list the projects on which the bidder was terminated, the nature of the termination (convenience, suspension, for cause), and the date of said termination.

IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #19 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

20. Has the bidder's surety ever been contacted to provide supervisory services in connection with an on-going project. If the answer to this question is yes, list the project(s) for which the surety provided supervisory services.

IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE LIST OF PROJECTS AS REQUIRED BY THIS QUESTION #20 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

_____

_____

21. Bidder's Worker's Compensation Experience Modifier: _____

Dated: _____

By: _____
(Signature)

_____
(Print Name and Title)

Sworn to before me this _____
day of _____, 20_____.

_____
Notary Public

Sexual Harassment Prevention Certification Form

By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that: the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace; the bidder provides annual sexual harassment prevention training to all of its employees; and that the principal(s) and all employees of the bidder have completed the sexual harassment prevention training in the last twelve (12) months. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

Bidder Name: _____

Bidder Address: _____

Print Name and Title: _____

Signature: _____

Date: _____

Sworn to before me this _____
day of _____, 20____

_____
Notary Public

SECTION 00 5200
FORM OF AGREEMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 FORM OF AGREEMENT

A. The Agreement to be executed is attached following this page.

1.3 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

AGREEMENT made as of the ___ day of _____ in the year of Two Thousand Twenty _____.

BETWEEN the Owner
(Name and address)

and the Contractor:
(Name and address)

The Project is:
(Name and location)

The Architect is:
(Name and address)

The Construction Manager is:
(Name and address)

The Owner and Contractor agree as set forth below.

ARTICLE 1
THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, specifications, Addenda issued prior to execution of this Agreement, other documents listed in Article 9 of this Agreement and Modifications issued after execution of this Agreement; these form the Contract and are a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

ARTICLE 2
THE WORK OF THIS CONTRACT

The Contractor shall execute the entire Work described in the Contract Documents or reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3
DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 The date of commencement of the work and substantial completion of the work of this contract shall be in accordance with the schedule set forth in the Project Manual.

3.2 Time is of the essence respecting the contract documents and all obligations thereunder.

3.3 Upon the execution of this Agreement, the Contractor shall provide the Owner with copies of all contracts entered into between the Contractor and subcontractors or material suppliers. The Contractor's obligation to provide the Owner with said contracts shall continue for the duration of the Project.

ARTICLE 4
CONTRACT SUM

4.1 The Owner shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of $_____, subject to additions and deductions as provided in the Contract Documents.

4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Bid Proposal Form (attached hereto) and are hereby accepted by the Owner:

4.3 Unit prices are as set forth in Exhibit A hereto.

ARTICLE 5
PROGRESS PAYMENTS

5.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

5.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

All progress payments shall be based upon an estimate and a certificate, made by the Architect, of the materials furnished, installed, and suitably stored at the site and the work done by the Contractor, and payment shall be made in installments of ninety-five percent (95%) of the amount certified as earned so that, at the completion of the work, there will be a retainage of five percent (5%) of the Total Contract Sum. Retainage shall be paid to the Contractor upon final completion of the work of this contract. All progress payments made previous to the last and final payment shall be based on estimates and the right is hereby reserved by the Architect for the Owner to make all due and proper corrections in any payment for any previous error.

The Contractor shall submit with each application for payment the following:

5.2.1 A current Sworn Statement from the Contractor setting forth all subcontractors and materialmen with whom the Contractor has subcontracted, the amount of such subcontract, the amount requested for any subcontractor or materialman in the application for payment and the amount to be paid to the Contractor from such progress payment.

5.2.2 Commencing with the second (2nd) Application for Payment submitted by the Contractor, duly executed so-called "after the fact" waivers of mechanics' and materialmen's liens from all subcontractors, materialmen and, when appropriate, from lower tier subcontractors, establishing receipt of payment or satisfaction of payment of all amounts requested on behalf of such entities and disbursed prior to submittal by the Contractor of the current Application for Payment, plus sworn statements from all subcontractors, materialmen and, where appropriate, from lower tier subcontractors, covering all amounts described in this Paragraph 5.2.

5.2.3 Such other information, documentation and materials as the Owner or the Architect may require.

5.3 Payment shall not be released to the Contractor until the Owner receives the following documentation:

5.3.1 Certified payroll for employees and employees of subcontractors performing work on the Project.

5.3.2 Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.

ARTICLE 6
FINAL PAYMENT

Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when (1) the Contract has been fully performed including compliance with all provisions of the Contract Documents except for the Contractor's responsibility to correct nonconforming Work under Article 15(B) of the General Conditions and to satisfy other requirements, if any, which necessarily survive final payment; and (2) a final Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows or as soon thereafter as is practicable.

ARTICLE 7
MISCELLANEOUS PROVISIONS

7.1 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

7.2 The Contractor represents and warrants the following to the Owner (in addition to any other representations and warranties contained in the Contract Documents) as an inducement to the Owner to execute this Agreement, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement and the final completion of the Work:

7.2.1 that it and its Subcontractors are financially solvent, able to pay all debts as they mature and possessed of sufficient working capital to complete the Work and perform all obligations hereunder;

7.2.2 that it is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder;

7.2.3 that it is authorized to do business in the State of New York and the United States and properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project;

7.2.4 that its execution of this Agreement and its performance thereof is within its duly authorized powers;

7.2.5 that its duly authorized representative has visited the site of the Project, is familiar with the local and special conditions under which the Work is to be performed and has correlated on-site observations with the requirements of the Contact Documents; and

7.2.6 that it possesses a high level of experience and expertise in the business administration, construction, construction management and superintendence or projects of the size, complexity, and nature of the particular Project, and that it will perform the Work with the care, skill, and diligence of such a contractor.

The foregoing warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor's duties, obligations, and performance hereunder. The Contractor's liability hereunder shall survive the Owner's final acceptance of and payment for the Work. All representations and warranties set forth in this Agreement, including without limitation, this Paragraph 7.2, shall survive the final completion of the Work or the earlier termination of this Agreement. The Contractor acknowledges that the Owner is relying upon the Contractor's skill and experience in connection with the Work called for hereunder.

ARTICLE 8
TERMINATION OR SUSPENSION

8.1 The Contract may be terminated by the Owner as provided in the General Conditions.

8.2 The Work may be suspended by the Owner as provided in the General Conditions.

ARTICLE 9
ENUMERATION OF CONTRACT DOCUMENTS

9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:

9.1.1 The Agreement is this executed Agreement between Owner and Contractor.

9.1.2 The General Conditions are the General Conditions of the Contract for Construction as set forth in the Project Manual and attached hereto.

9.1.3 The Specifications are as set forth in the Project Manual and indexed in Exhibit "B" hereto.

9.1.4 The Drawings are those as indexed in Exhibit "C" hereto.

9.1.5 The Addenda, if any, are as follows:

Addendum No.	Date	Number of Pages

This Agreement is entered into as of the day and year first written above and is executed in at least three original copies of which one is to be delivered to the Contractor, one to the Architect for use in the administration of the Contract, and the remainder to the Owner.

OWNER	CONTRACTOR
By: _____	By: _____
_____ (printed name and title)	_____ (printed name and title)

SECTION 00 6000
BONDS AND CERTIFICATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 BID BOND:

A. A Bid Bond will be required for this project. Each individual bid shall be accompanied by a check upon a duly authorized State, National Bank or Trust Company, duly certified in the sum equal to TEN (10%) percent of the total amount of the bid, including alternates or a Bid Bond in the amount of TEN (10%) of the bid, including alternates payable to the Edgemont Union Free School District and shall be enclosed in an envelope containing the bid; as a guarantee that the Bidder will, after the award is made to him, enter into a bona fide contract with the Owner for the work, and furnish the bonds and liability policies as required under the specifications. The AIA 310 - 2010 edition entitled "Bid Bond" shall be the contract bond form for this project. A draft copy is attached.

1. Each bid bond must also be accompanied by the written consent of the Surety Company authorized to do business in the State of New York and be A.M Best "Secured" rated or better.

2. Attorney-in-fact who execute said bonds on behalf of a surety must affix thereto a certified and effectively dated copy of their Power of Appointment and Certification of an officer of the surety that the Power of Attorney continues in effect.

B. If, for any reason, whatsoever, the Bidder fails to enter into a proper contract and to execute the proper bonds, as required by these specifications, the amount of said guarantee retained by the Owner shall be larger amount of (a) the Bid Bond or (b) the difference between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the Work

C. All certified checks, except the check of the Bidder to whom a contract is awarded, will be returned to the respective Bidders, as soon as the Letter of Award has been issued by the Owner.

1. The check of the Bidder, to whom a contract has been awarded, shall be retained until the contract has been executed and all bonds together with an approved liability insurance policy are filed with the Owner.

1.3 PERFORMANCE BOND, LABOR AND MATERIAL PAYMENT BOND AND MAINTENANCE BOND.

A. Refer to Section 00 7200 - General Conditions, Article 11 for bonding requirements.

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR: **SURETY:**

OWNER:
Edgemont Union Free School District
300 White Oak Lane
Scarsdale NY, 10583

BOND AMOUNT: $

PROJECT:
Edgemont School District

Seely Place Elementary School & Greenville Elementary School
Interior Renovations and SIte Improvement

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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User Notes: (681bcae8574eb3daf0331478)

Signed and sealed this day of ,

CONTRACTOR AS PRINCIPAL *(Signature)*	**SURETY** *(Signature)*
(Printed name and title)	*(Printed name and title)*
(Witness)	*(Witness)*

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User Notes: (681bcae8574eb3daf0331478)

AIA® Document A312® – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
Name, legal status and principal place of business)

OWNER:
Edgemont Union Free School District
300 White Oak Lane
Scarsdale NY, 10583

BOND

Date:
(Not earlier than Construction Contract Date)

Amount: $

Modifications to this Bond:		None		See Section 18

Company: *(Corporate seal)*

Company: *(Corporate seal)*

CONTRACTOR AS PRINCIPAL
(Signature)

SURETY *(Signature)*

(Printed name and title)

(Printed name and title)

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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User Notes: (681bcaac574eb3daf03313ad)

AGENT or BROKER:	OWNER'S REPRESENTATIVE: *(Architect, Engineer or other party:)*

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant

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under this Bond and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all documents..

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to allow Contractor access to site to complete project in accordance with the contract schedule.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

1. .1 Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner and the Owner shall have thirty (30) days from the time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified or registered U.S. Mail, return receipt requested, first-class postage prepaid to Owner.
2. .2 Surety agrees that it is obligated under the bonds to any successor, grantee or assignee of the Owner
3. .3 Each material or equipment supplier or subcontractor shall provide a partial release of liens every 60 days or as otherwise agreed upon between Owner and Contractor.

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

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AIA® Document A312® – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
Edgemont Union Free School District
300 White Oak Lane
Scarsdale NY, 10583

CONSTRUCTION CONTRACT
Date:
Amount: $ 0.00
Description:
Edgemont School District
Seely Place Elemenary School and Greenville Elementray School
Interior Renovations and Site

BOND

Date:
(Not earlier than Construction Contract Date)

Amount: $

Modifications to this Bond:		None		See Section 16	

Company: *(Corporate seal)*

Company: *(Corporate seal)*

CONTRACTOR AS PRINCIPAL *(Signature)*

SURETY *(Signature)*

(Printed name and title)

(Printed name and title)

(Any additional signatures appear on the last page of this Performance Bond.)

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 When the Claimant has satisfied the conditions of Paragraph 4, and has submitted all supporting documentation and any proof of claim requested by the Surety, the Surety shall, with reasonable promptness, notify the Claimant of the amounts that are undisputed and the basis for challenging any amounts that are disputed, including, but not limited to, the lack of substantiating documentation to support the claim as to entitlement or amount, and the Surety shall, with reasonable promptness, pay or make arrangements for payment of any undisputed amount; provided, however, that the failure of the Surety to timely discharge its obligations under this paragraph or to dispute or identify any specific defense to all or any part of a claim shall not be deemed to be an admission of liability by the Surety as to such claim or otherwise constitute a waiver of the Contractor's or Surety's defenses to, or right to dispute, such claim. Rather, the Claimant shall have the immediate right, without further notice, to bring suit against the Surety to enforce any remedy available to it under this Bond.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the

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Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

1. .1 Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change or

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other modification of the Contract Documents. Such addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder ad notice to the Surety of such matters is hereby waived.

2. .2 Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner and the Owner shall have thirty (30) days from the time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified or registered U.S. Mail, return receipt requested, first-class postage prepaid to Owner.
3. .3 Surety agrees that it is obligated under the bonds to any successor, grantee or assignee of the Owner

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

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SECTION 00 7200
GENERAL CONDITIONS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 FORM OF GENERAL CONDITIONS

A. The General Conditions applicable to this contract is attached following this page.

1.3 RELATED REQUIREMENTS

A. Section 00 5200 - Form of Agreement

END OF DOCUMENT

GENERAL CONDITIONS

of the

CONTRACT for CONSTRUCTION

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GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The within document includes detailed provisions concerning the capital improvement work to be performed by the Contractors engaged by the Owner. This document contains provisions which relate particularly to capital improvement projects in the school district setting in New York State. The document is incorporated by reference into all contracts to be awarded and should be reviewed carefully by the Contractor and SubContractors to whom the award of contract is made. Consultation with an attorney and insurance representative is advised.

ARTICLE 1
DEFINITIONS

A. "Addendum" or "Addenda" refers to revised Drawings and/or written requirements for the capital improvement work issued by the Architect prior to the time indicated for submission of a bid by a contractor.

B. The "Architect" is the design professional engaged by the School District respecting the capital improvement projects to be performed in the School District.

C. "Board" refers to the Board of the School District.

D. "Central Administration" refers to the Superintendent of Schools or designee.

E. The "Construction Manager" is the entity engaged by the School District to act as its representative during the course of construction of the Project.

F. The "Contract Documents" are the Agreement between the Owner and the Contractor, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda which have been issued.

G. The "Contractor" refers to the entity engaged by the School District to perform all or a part of the capital improvement project on its behalf.

H. Where a contractor other than the General Contractor is the only contractor engaged to perform work, the responsibilities allocated to the General Contractor in these General Conditions shall be performed by such other contractor.

I. The "Drawings" are the plans, elevations, sections, details, schedules, and diagrams developed by the Architect for the capital improvement projects to be performed in accordance with the Project manual of which these General Conditions of the Contract for Construction ("General Conditions") form a part.

J. The "Project" refers to the entire capital improvement project to be performed in accordance with the Project Manual.

K. The "Project Manual" is the document which is issued simultaneously with the Drawings and includes the Notice to Bidders, Information to Bidders, Bid Proposal Form, Prevailing Wage Rate schedule and the written requirements for labor, materials, equipment, construction systems and the like necessary for the Contractor to complete the capital improvement work for which it has been engaged.

L. The "Owner" refers to the School District, the Board of Education, its officers, agents, and employees.

M. A "SubContractor" is a person or entity who has a direct contract with the Contractor to provide material and/or labor for the Project on or off the site, or to otherwise furnish labor, material or other services with respect to a portion of the Contractor's work. A "Sub-SubContractor" is a person or entity who has a direct or indirect contract with a SubContractor engaged by the Contractor to perform a portion of the SubContractor's work at the site, or to otherwise furnish labor, material, or other services with respect to a portion of the SubContractor's work.

N. Accepted," "directed," "permitted," "requested," "required," and "selected" mean, unless otherwise explained, "accepted by the Architect and/or the Owner" "directed by the Architect and/or the Owner," "permitted by the Architect and/or the Owner," "requested by the Architect and/or the Owner," "required by the Architect and/or the Owner," and "selected by the Architect and/or the Owner." However, no such implied meaning will be interpreted to extend the Architect's or the Owner's responsibility into the Contractor's area of construction supervision.

O. "As accepted" "or acceptable substitute," and "for review" mean the Architect is the sole judge of the quality and suitability of the proposed substitutions. Where used in conjunction with the Architect's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the meaning will be held to the limitations of the Architect's responsibilities and duties as stated in the General Conditions. In no case will "accepted by the Architect" be interpreted as an assurance to the Contractor that the requirements of the Contract Documents have been fulfilled.

P. "Furnish" means: (1) supply and deliver to the Project or other designated location, ready for unloading, unpacking, storing, assembly, installation, application, erection, or other form of incorporation into the Project, and ready for use; and (2) supply and deliver products requiring additional or supplemental fitting, assembly, fabrication, or incorporation into other elements of the Project directly to the fabricator, installer, or manufacturer as required.

Q. "Install" means unload, unpack, use, fit, attach, assemble, apply, place, anchor, erect, finish, cure, protect, clean, and similar operations required to properly incorporate work into the Project.

R. "Provide" means furnish and install.

S. "Replace" means remove designated, damaged, rejected, defective, unacceptable, or non-conforming work from the Project and provide new work meeting the requirements of the Contract Documents in place thereof.

T. The word "include," in any form other than "inclusive," is non-limiting and is not intended to mean all-inclusive.

ARTICLE 2
CONTRACTOR'S REPRESENTATIONS

A. Upon submission of its bid to the Owner, the Contractor expressly represents:

1. The Contractor represents and warrants that it performed a detailed investigation of the site(s) and that such investigation was sufficient to disclose the conditions of the site(s) at which work is to be performed by it and all improvements thereon, and the conditions under which the work is to be performed, including, but not limited to (a) the location, condition, layout and nature of the Project and surrounding areas; (b) the cost of labor, materials and equipment necessary to perform the work, the availability; (c) the areas of the work which will cause a disruption to the necessary and proper operation of the facilities by the Owner; and (d) other pertinent limitations on the performance of its work.

2. The Contractor represents and warrants that it has carefully studied and compared the Drawings and pertinent provisions of the Project Manual and that any errors, omissions, ambiguities, discrepancies, or conflicts found in said documents have been brought to the attention of the Architect for clarification prior to the Contractor's submission of its bid. If, in the interpretation of Contract Documents, requirements within the Drawings and Specifications conflict, or it appears that the Drawings and Specifications are not in the Agreement, the requirement to be followed shall be decided by the Architect. Where there is a discrepancy in quantity, the Contractor shall provide the greater quantity; where there is a discrepancy in quality, the Contractor shall provide the superior quality. Addenda supersede the provisions that they amend.

3. Each contractor certifies that it is experienced and familiar with the requirements and conditions imposed during the construction of similar work in the area. This includes, but is not limited to, "out of sequence" or "come back" work for the removal of plant, equipment, temporary wiring, or plumbing, etc. This "out of sequence" work may also include phasing of construction activities to accommodate the installation of the work at various locations and orderly fashion and the completion of work at various locations and/or levels at various times. This "phasing," "out of sequence," or "come back" work shall be done at no cost to other contractors, the Owner, the Architect, or the Construction Manager.

B. The Contractor warrants to the Owner that: (1) the materials and equipment furnished under its contract will be of good quality and new, and of recent manufacture, unless otherwise required or permitted by the Contract Documents; (2) that its work will be free from defects not inherent in the quality required or permitted; and (3) that its work will conform with the terms

and conditions of the Agreement with the Owner. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective and shall be removed and replaced at the Contractor's cost and expense. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

C. Except as to any reported errors, inconsistencies, or omissions, and to concealed or unknown conditions, by executing the Agreement, the Contractor represents the following:

1. The Drawings and the Specifications found in the Project Manual issued simultaneously with said Drawings are sufficiently complete and detailed for the Contractor to: (a) perform the work required to produce the results intended by the Owner; and (b) comply with all the requirements of its contract with the Owner.

2. The work required to be performed by the Contractor including, without limitation, all construction details, construction means, methods, procedures and techniques necessary to perform its work, use of materials, selection of equipment and requirements of product manufacturers are consistent with: (a) good and prevailing and accepted industry standards applicable to its work; (b) requirements of any warranties applicable to its work; and (c) all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies which bear upon the Contractor's performance of its work.

3. The Drawings and the Specifications for the Contract have been prepared with care and are intended to show as clearly as is practicable the work required to be done. Work under all items in the Contract Documents must be carried out to meet field conditions to the satisfaction of the Architect and the Owner and in accordance with his instructions and the Drawings and the Specifications.

4. All dimensions shown on the Drawings are for bidding purposes only. It is the responsibility of the Contractor to verify all dimensions in the field to ensure proper and accurate fit of materials and items to be installed.

D. The representations set forth herein shall survive expiration and/or termination of the Contractor's Agreement with the Owner.

ARTICLE 3
CONTRACTOR'S CONSTRUCTION PROCEDURES

A.

1. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures required for the proper execution of its work on the Project. Where the Drawings, the Specifications, and/or the Project Manual make reference to particular construction means, methods, techniques, sequences or procedures or indicate or imply that such are to be used in connection with the Contractor's work, such reference is intended only to indicate that the Contractor's work is to produce at least the quality

of the work implied by the operations described, but the actual determination as to whether or not the described operations may be safely or suitably employed in the performance of the Contractor's work shall be the sole responsibility of the Contractor. All loss, damage, liability, or cost of correcting defective work arising from the employment of a specific construction means, method, technique, sequence, or procedure shall be borne solely by the Contractor.

2. Neither the Architect, the Construction Manager or the Owner will have control over or charge of and will not be responsible for construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided herein.

3. The Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, rigging, water, heat, utilities, light, transportation, and other facilities and services necessary for proper execution and completion of its work, whether temporary or permanent and whether or not incorporated or to be incorporated in its work.

B. The Contractor shall be responsible for coordinating the work of its own forces and the work of SubContractors engaged by it to perform the work of the Project on its behalf. The Contractor shall supply to its own work forces, and SubContractors engaged by it to perform portions of its work, copies of the Drawings, the Specifications, and the Project Manual for the work to be performed by such individuals/entities on its behalf. The Contractor shall review any specified or installation procedure with its employees and/or SubContractors, including those recommended by any product manufacturer, prior to the commencement of the relevant portion of the work to be performed. The Contractor shall be responsible to the Owner for the acts and/or omissions of the Contractor's employees, the Contractor's SubContractors, the Contractor's material suppliers, and/or their respective agents and employees, and any other persons performing portions of the work on behalf of the Contractor.

C. The Contractor shall be responsible for the inspection of portions of the Project performed by its own work force and/or SubContractors engaged by it for the purpose of determining that said work is in proper condition to receive subsequent work.

D. The Contractor shall perform its work in accordance with the standards of the construction industry applicable to work in the locale in which work is to be performed.

E. The Contractor shall only employ labor on the Project or in connection with its work capable of working harmoniously will all trades, crafts and any other individuals associated with the capital improvement work to be performed. There shall be no strikes, picketing, work stoppages, slowdowns, or other disruptive activity at the Project for any reason by anyone employed or engaged by the Contractor to perform its portion of the work. There shall be no lockout at the Project by the Contractor. The Contractor shall be responsible for providing the manpower required to proceed with the work under any circumstance. Should it become necessary to create and maintain a separate entrance for a contractor involved in a labor dispute, all costs associated with creating and maintaining that entrance shall be borne by the contractor involved in the dispute. Such costs shall include, but not be limited to, signage, fencing,

temporary roads, and security personnel as deemed necessary by the Owner for the safety of the occupants of the site.

F.

1. If the Contractor has engaged the services of workers and/or SubContractors who are members of trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage, or cost to the Owner and without recourse to the Architect, the Construction Manager, or the Owner, any conflict between its Agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade.

2. In case the progress of the capital improvement work to be performed by the Contractor is effected by any undue delay in furnishing or installing any items or materials or equipment required pursuant to its Agreement with the Owner because of a conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive but in no case shall the amount of such change be charged by the Contractor to the Owner as an additional cost to perform the capital improvement work pursuant to its contract.

3. The Contractor shall ensure that its work continues uninterrupted during the pendency of a labor dispute.

4. The Contractor shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes, or strikes.

G. The Contractor shall enforce strict discipline and good order among the Contractor's employees and its SubContractors' work forces and other persons carrying out the performance of its work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Owner reserves the right to object to any person to be hired or who is employed by the Contractor. Upon the request of the Owner, said person shall be removed from the Project and not again be assigned to perform the Contractor's work without the prior written permission of the Owner.

H. Within one (1) week after receiving notice of its award of the Contract, the Contractor shall employ a competent, full-time Project Manager and On Site Superintendent to be approved by the Owner or its representative, and such necessary assistants who shall be in attendance at each Project site whenever and wherever work is in progress to provide for the expeditious completion of the work. Said Project Manager and On Site Superintendent shall be employed until punch list and closeout of the Project. To the extent work is being performed contemporaneously at different facilities within the School District, the Contractor shall assign different superintendents for each facility at which work is being performed. The Project Manager and On Site Superintendent assigned by the Contractor shall not be changed except with the prior written consent of the Owner, unless the Project Manager or On Site superintendent or such assistant proves to be unsatisfactory to the Contractor and/or ceases to be in its employ. The Project Manager and On Site Superintendent shall represent the Contractor, and communications given to the Project

Manager or On Site Superintendent, whether verbal or written, shall be as binding as if given to the Contractor. Oral communications to the Superintendent(s) or his/her assistant(s) and/or Project Manager shall be confirmed in writing by the Owner or the Architect. The Contractor shall forward to the Owner a copy of the resumes for each of its superintendents, Project Managers, and their assistants. The Owner, the Construction Manager or the Architect shall have the right to have any supervisory or management staff removed from the Project with or without cause.

I. Each Contractor shall provide, or otherwise see that, the Project Manager, or On Site Superintendent Site Managers, and/or responsible workers of each contractor and major subcontractor are equipped with cellular phones and radios. Each contractor shall provide the Owner, the Construction Manager, and the Architect with the cellular telephone number for each phone and worker.

J. The Contractor's supervisory personnel, including superintendents and their assistants, shall be versed in the English language. In the event the Contractor's supervisory personnel, the superintendents, Project Managers, and/or their assistants are not versed in the English language, the Contractor shall employ the services of a full-time on-site interpreter to facilitate communications with such supervisory personnel, superintendents and/or assistants.

K. Prior to the commencement of work, the Contractor shall provide the Construction Manager and the Architect with:

1. a written list of the names, addresses and telephone numbers of the members of its organization who can be contacted in the event of an off-hours emergency at the building site, including cellular telephone numbers and personal/home telephone numbers.

2. a written list of SubContractors, Sub-SubContractors, suppliers and vendors with names, addresses, telephone numbers, and descriptions of the work they shall perform or furnish.

3. The name, address and telephone number of the bonding company, banking, and insurance company for the Prime Contractor including the name, address, and telephone number of each bonding company's primary contact representative for the Project.

4. Detailed subcontractor schedules indicating the approximate quantity of shop drawings, sequence, timing, and man loading.

5. A cash flow projection for the life of the Project, including a schedule and graph showing the amount of work projected to be completed each month or billing period and a dollar value for the anticipated billings each month or billing period. This shall be completed after an agreed upon schedule of values has been approved by the Construction Manager.

L.

1. Tests, inspections, and approvals of portions of the Contractor's work required by the Drawings and/or the Specifications shall be made at an appropriate time. Unless otherwise provided, the Contractor shall consult with the Architect and the Construction Manager

concerning the need for testing and/or inspection of its work pursuant to the Contract Documents and, after consulting with the Architect and the Construction Manager, the Construction Manager shall advise the Owner to make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority. The Owner shall bear all costs associated with the tests, inspections or approvals required by the Drawings and/or the Specifications, except as set forth in subparagraph 3 hereof.

2. Tests, inspections, and approval of portions of the Contractor's work required by all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies having jurisdiction shall be made at an appropriate time. The Contractor shall consult with the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to law, ordinance, regulation or orders of public authorities or governmental agencies and shall advise the Owner in writing that it has made arrangements for such tests, inspections and approvals with the appropriate public authority or governmental agency. The Contractor shall be solely responsible for making timely notice of the need for a test, inspection and/or approval with the relevant public authority or governmental agencies and shall bear all costs associated with such testing, inspection, or approval required by such public authority or governmental agency.

3. If the Architect, the Construction Manager, the Owner, or public authorities or governmental agencies having jurisdiction determine that portions of the Contractor's work require additional testing, inspection, or approval due to the Contractor's failure to perform its work in accordance with the requirements of the Contract Documents and/or all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies having jurisdiction, the Architect and the Construction Manager will advise the Owner of the need for such additional inspections or tests and the Owner shall make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner. The Contractor shall bear the costs of such additional testing as provided in Article 14(B).

M. The Contractor shall, if required by all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies having jurisdiction over the Project, retain a licensed professional engineer to supervise the construction of the Project including, but not limited to, foundations, structural work, soils, welding, reinforced masonry, and the like.

N. The Contractor recognizes and acknowledges that the Project is governed by and subject to the provisions of New York State General Municipal Law, Section 101, governing the award of contracts on public improvement projects. As such, the Contractor recognizes and acknowledges that other contractors will be performing work on the Project in conjunction with it. As such, the Contractor agrees to cooperate with such other contractors performing work on the Project and shall perform its work as follows:

1. The Contractor shall not interfere with the erection, installation, or storage upon the premises of any work, materials, supplies, or equipment which is to be performed and

furnished by other contractors, and the Contractor shall properly connect and coordinate its work therewith.

2. The Contractor shall not commit or permit any act which will interfere with the performance of the work of any other Contractor performing work on the Project. If the Contractor sustains any damage through any act or omission of other contractors having a contract with the Owner for the performance of work upon the site or of work which may be necessary to be performed for the proper execution of the work to be performed hereunder, or through any act or omission of a SubContractor of such contractor, the Contractor shall promptly notify the Owner and the Construction Manager of such damage.

3. When the work of the Contractor or its SubContractors overlap or dovetail with that of other contractors, materials shall be delivered and operations conducted to carry on the work continuously, in an efficient, workmanlike manner.

4. In case of interference between the operations of different contractors, the Construction Manager will be the sole judge of the rights of each contractor and shall have the authority to decide in what manner the work may proceed, and in all cases its decision shall be final. Any decision as to the method and times of conducting the work or the use of space as required in this paragraph shall not be basis of any claim for delay or damages by the Contractor.

5. The Contractor, including its SubContractors, shall keep itself informed of the progress of other contractors and shall notify the Architect or the Construction Manager immediately in writing of lack of progress on the part of other contractors where such delay will interfere with its own operations. Failure of the Contractor to keep informed of the work progressing on the Project and failure to give notice of lack of progress by others shall be construed as acceptance by the Contractor of the status of the work as being satisfactory for proper coordination with the Contractor's own work.

6. Delays or oversights on the part of any contractor or subcontractor in getting any or all of their work done in the proper way, thereby causing cutting, removing, and replacing work already in place, shall not be the basis for a claim for extra compensation.

7. If part of the Contractor's work depends upon construction or operations by the Owner or another contractor, the Contractor shall, prior to proceeding with that portion of its work, promptly report to the Architect and the Construction Manager apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or other contractor's completed or partially completed construction is fit and proper to receive the Contractor's work.

8. The Contractor shall promptly correct discrepancies or defects in its work which have been identified by other contractors as affecting proper execution and results of the work of such other contractor.

O.

1. The Contractor shall comply with and give notices required by all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies bearing on performance of the Work. If the Contractor fails to give such notices, it shall be liable for and shall defend, indemnify, and hold harmless: (a) the Owner, its consultants, employees, members of the Board, officers, and agents; (b) the Architect and its consultants, employees, officers, and agents; and/or (c) the Construction Manager and its consultants, employees, officers, and agents from and against any resulting fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation.

2. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation. If the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and the Owner in writing, and necessary changes shall be accomplished by appropriate modification to the Drawings and/or the Specifications.

3. If the Contractor performs Work knowing it to be contrary to all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies without such notice to the Architect, the Construction Manager, and the Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs and shall bear the total cost for correction of same.

P. The Contractor recognizes and acknowledges that job meetings will be held at the job site as designated by the Owner or the Construction Manager, unless otherwise designated by the Owner or the Architect. The Contractor shall have responsible representation at the MANDATORY weekly job meetings held at the Construction Manager's job office. These meetings will be held to arrange for satisfactory coordination of all trades on the Project so as not to impede job progress. Contractors or SubContractors failing to attend job meetings shall be responsible for delays and/or expenses incurred due to coordination difficulty.

Q. The Contractor shall provide copies of its daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00 am the following workday. The daily reports shall provide detailed information concerning the Contractor's activities and operations, including work activities on site and manpower. A "Daily Construction" form shall be used for reporting these activities. In addition, the Contractor is required to submit a Two Week Look Ahead schedule for upcoming work.

ARTICLE 4
CONTRACTOR'S USE OF SITE

A. The Contractor shall confine operations at the site to the areas at which construction is to be performed and to such areas permitted by law, ordinances, permits and as set forth in detail in the Project Manual and the Drawings, the Specifications, and the Project Manual.

B. Five (5) days after receipt of the Notice to Proceed, the Contractor shall provide two (2) copies of a videotaped recording of all existing conditions to the Construction Manager. This taping shall provide a record of all existing buildings, grounds, exterior conditions, and interior conditions. The Contractor shall schedule a representative of both the Owner and the Construction Manager to be present at this taping. In the absence of this record, the Contractor shall be responsible for paying the costs associated with any and all repairs in an area where the Contractor is working or has worked, as may be deemed necessary by the Owner or the Construction Manager.

C. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

D. General Safety and Security Standards for Construction Projects:

1. All construction materials shall be stored in a safe and secure manner.

2. Fences around construction supplies or debris shall be maintained.

3. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.

4. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.

5. The Contractor shall exert utmost care and diligence when working in or near any existing buildings or sitework. The absence of protection around such items shall not excuse the Contractor from its liability to provide protection. Any damage to existing buildings, sitework, or facilities shall be repaired and charged to the Contractor responsible for the damage.

6. The Contractor shall be responsible for the removal and replacement of existing ceiling tiles and grid in areas of the existing building where its work is required, and new ceilings are not scheduled for installation. In the event that the existing ceilings are damaged and cannot be replaced to the satisfaction of the Owner, the responsible contractor shall be liable for the costs of replacing in kind, the existing ceilings with new tile and grid.

7. All disconnect and/or tie-in work involving any utilities that would interfere with the ongoing operations of the Owner shall be completed after hours when the facility is not in

use. The performance of this work shall be projected on all schedules required to be prepared by the Contractor. Additionally, the Contractor shall give the Construction Manager and the Owner at least forty-eight (48) hours advance written notice of its intention to perform this type of work. All overtime and standby personnel necessary to complete these tie-ins shall be the responsibility of the Contractor performing the work.

E.

1. Separation of construction areas from occupied spaces: Construction areas which are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust, or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas. Methods of dust and fume control shall include, but not be limited to:

a. adequate ventilation;

b. wetting down;

c. keeping bags of insulating materials, cement, etc., closed and sealed;

d. controlled mixing of materials under field conditions;

e. special attention should be utilized in sawing of insulation and certain acoustical materials and storage of materials;

f. job housekeeping must be maintained; and

g. advising all personnel of hazardous conditions, including supervisors and workers.

Each contractor is responsible for instituting the above policies to ensure minimal impact to surrounding occupied areas.

2. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs, or elevators designated for students or school staff.

3. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

4. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety, and educational capabilities at all times that classes are in session.

F.

1. Storage space will be allotted to the Contractor by the Owner to the extent such space, in the sole discretion of the Owner, is available. The Contractor shall be responsible for securing appropriate space for its material with the Construction Manager prior to delivery. If insufficient space is available on the site, the Contractor shall provide local off-site storage, storage containers, etc. at its own cost and expense. Should any of the material stored on-site obstruct the progress of any portion of the work or the Project, this material shall be removed by the Contractor without reimbursement of cost, from place to place or from the premises, as the Construction Manager may direct.

2. The Contractor shall schedule delivery of materials and equipment to minimize long term storage at the Project, to prevent overcrowding of construction spaces, and to ensure that under no circumstances will materials that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses be stored on site.

3. The Contractor shall deliver materials and equipment to the Project in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installation. The Contractor shall inspect materials and equipment upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. The Contractor shall store products to allow for inspection and measurement of quantity or counting of units. The Contractor shall store materials in a manner that will not endanger the project structure. The Contractor shall store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation. The Contractor shall comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

4. The Contractor shall not unreasonably encumber the site with materials or equipment during the performance of its work. Only materials and equipment which are to be used directly in the performance of the Contractor's work shall be brought to and stored on the premises of the School District. After equipment is no longer required for its work, the Contractor shall promptly remove such equipment from the premises of the School District. The Contractor shall be solely responsible for the protection of construction materials and equipment stored on the premises from weather, theft, damage, and all other adversity. The Contractor shall at all times provide the proper housekeeping to minimize potential fire hazards and shall provide approved spark arresters on all steam engines, internal combustion engines and flues.

5. A construction entrance will be designated for deliveries. A separate entrance will be established for entering and exiting the site only. All deliveries shall be scheduled and

coordinated with the Construction Manager and the Owner. Unexpected or uncoordinated deliveries may be turned away by the Owner or the Construction Manager at the discretion or necessity of the Owner. The Owner's enforcement of this provision shall not be construed by any contractor or subcontractor as the basis for a claim of delay in time or monetary damages alleged to have been incurred as a result of refusal of delivery.

6. The Contractor for General Construction shall provide necessary and required security measures to adequately safeguard the construction site from vandalism and intrusion of unauthorized persons. The Contractor for General Construction shall submit its means and methods of security to the Construction Manager for review and comment. The Project must be secured twenty-four (24) hours a day, seven (7) days a week including holidays. The General Construction Contractor's failure to secure the site as required by this paragraph will result in the Owner engaging the services of such necessary personnel so as to provide such security. No notice will be given the Contractor for General Construction of the Owner's intention to engage such security services and all costs and expenses associated with the Owner's security of the site in this regard will be back charged to the Contractor for General Construction. While the Owner may have security guards patrolling the Project, the function of such security guards is not for the purpose of specifically guarding the Contractor's property or operations of work.

G. The Contractor's right to entry and use of the School District premises arises solely from the permission granted by the Owner pursuant to the Agreement between the Contractor and the Owner. This permission shall be deemed to be withdrawn upon the termination of the Contractor's Agreement with the Owner.

H.

1. The Contractor shall be required to perform its work with no interruption to the School District's operations, including its administrative and business operations. Any work which will interfere with the School District's operations and/or which is to be performed when the School District's facilities are in operation shall be performed on evenings and weekends. Additionally, the Contractor shall conduct its work in compliance with federal, state, county, or local ordinances. All costs incurred by the Owner to make the facilities available during evening and weekends shall be borne by the Contractor. The Owner reserves the right to determine what work will "interfere" with its operations and said determination shall be final.

2. The Contractor may request access to the site during times beyond the work hours permitted. Approval is solely at the discretion of the Owner. If approval is given, the Contractor is responsible for paying all additional costs incurred by the Owner, the Architect, and the Construction Manager for providing the site to the Contractor during the additional time periods.

3. In the event the Contractor fails to complete all work under the Contract Documents by said scheduled dates, the Contractor will not be permitted to perform any work during normal school hours. Such work shall only be performed after school hours, Saturdays, Sundays, holidays, or periods when school is unoccupied at no additional cost of any kind to the Owner. In addition to damages incurred by the Owner in connection with the Contractor's delay, the Contractor shall be liable for all costs incurred by the Owner to provide staff and the

Architect's and the Construction Manager's personnel as required to make facility accessible by the Contractor and perform inspections during such off hours.

4. The Owner shall not be responsible for any overtime charges incurred by the Contractor during the course of the Project. Any and all costs associated with work which is performed at hours requiring the payment of such overtime by the Contractor to its workers shall be the Contractor's responsibility.

I. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupies or acoustical abatement measures shall be taken.

J. The Contractor shall provide all required temporary access walkways, both interior and exterior, and the like necessary to complete its work. The Contractor shall maintain an unobstructed condition at all entrances and/or exits from present buildings. No equipment, other than equipment with rubber tires, will be allowed on any existing or new pavement, UNLESS THE CONTRACTOR HAS OBTAINED THE PRIOR WRITTEN APPROVAL OF THE CONSTRUCTION MANAGER AND THE PAVEMENT HAS BEEN FIRST PROTECTED WITH PLANKING OR BY OTHER MEANS APPROVED BY THE CONSTRUCTION MANAGER.

K. The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the premises of the School District without the prior written consent of the Owner, which consent may be withheld at the sole discretion of the Owner.

L.

1. Without the prior approval of the Owner, the Contractor shall not permit any workers to use any existing School District facilities, including, without limitation, lavatories, toilets, entrances, and parking areas other than those designated by the Owner. Employees, vehicles, and equipment of the Contractor and of all others engaged by the Contractor for the performance of its work shall enter onto the premises of the School District for which construction work is to be performed only at those locations designated or approved by the Construction Manager. The parking for construction personnel shall be limited to the designated trailer park area only. Failure to abide by this rule will result in towing of cars at the expense of the Contractor who employs the individual.

2. The Contractor shall ensure that its work, at all times, is performed in a manner that affords reasonable access to both vehicles and individuals, to the premises of the School District and all adjacent areas. The Contractors' work shall be performed, to the fullest extent possible, in such a manner that areas in and around the construction area shall be free from all debris, building materials and equipment likely to cause hazardous conditions, and do not close or obstruct walkways, roadways, pathways, or other occupied facilities or facilities to be used by the Owner. Without limitation to any other provision of the Agreement between the Contractor and the Owner, the Contractor shall use its best efforts to minimize any interference with the occupancy of areas, buildings, entrances, and parking areas in and around the premises at which work is being performed. Free access to fire hydrants and standpipe connections shall be

maintained at all times during construction operations, and portable fire extinguishers shall be provided by the Contractor and made conveniently available throughout the construction site.

3. The Construction Manager, in conjunction with the Owner and the Architect, shall designate locations at the site at which the Contractor, its SubContractors and employees may utilize in connection with its work. The Contractor's employees and the employees of the Contractor's SubContractors and others engaged by the Contractor to perform its work are prohibited from trespassing or leaving any vehicle on any property not assigned by the Owner as set aside for the use of the Contractor. The Contractor's employees and the employees of the Contractor's SubContractors and others engaged by the Contractor to perform its work are restricted to the immediate area at which work is to be performed. Only persons having official business will be admitted to the construction site. NO COMMUNICATION BETWEEN THE CONTRACTOR, ITS EMPLOYEES, SUBCONTRACTORS' EMPLOYEES, OR OTHERS ENGAGED BY THE CONTRACTOR FOR THE PERFORMANCE OF ITS WORK AND STUDENTS OR STAFF WILL BE PERMITTED.

4. The Contractor, its SubContractors, their respective employees or agents, and all others engaged by the Contractor in connection with the performance of its work are required to wear photographic identification badges at all times. The Contractor shall provide such individuals with said photographic identification badges. These badges shall be worn so as to be readily and easily visible. All workers and representatives of the Contractor, its SubContractors, or suppliers shall wear these badges while on school property. The information on these badges shall be as prescribed by the Owner and the Construction Manager. Each person seen without a photo identification badge (or otherwise failing to comply with this requirement in the opinion of the Owner or the Construction Manager) shall be ordered to leave school property. No warnings shall be necessary. The Contractor(s) and their SubContractor(s) employing the offending person(s) shall be solely responsible for making-up and paying for any loss of production or required progress in the Work resulting from this action (including any claims by other Contractors dependent on the work of this Contractor). All parties agree that any action taken to enforce this requirement shall not be construed by any Contractor or its SubContractors or suppliers as the basis for a claim (for either time or money) for delay to the Work or to the Contractor, its SubContractors, or Suppliers.

5. Without limitation of any other provision of the Agreement between the Owner and Contractor, the Contractor shall use its best efforts to comply with all rules, regulations, and policies promulgated by the Owner in connection with the use and occupancy of the premises of the School District. The Contractor shall immediately notify the Owner in writing if during the performance of its work, the Contractor finds compliance with any portion of such rules, regulations, and policies to be impracticable, setting forth the problems of such compliance and suggesting alternative through which the same results intended by such portion of the rules, regulations, and policies can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives, or require compliance with the existing requirements of the rules, regulations, and policies.

M. No drinking of alcoholic beverages, smoking, or use of cannabis, cannabinoid hemp, personal vaporizing devices, or controlled substances is permitted on the grounds. The Contractor shall ensure that none of its or its SubContractors, their respective employees, agents, and/or consultants report to the site impaired by alcohol, cannabis/cannabinoid hemp, or controlled substances. The Contractor bears the responsibility of determining if its, or its SubContractors' employees are in any way impaired and whether the safety of the public, the employees of other Contractors and their SubContractors, the Owner, the Architect, or the Construction Manager are jeopardized. Each contractor shall provide drinking water for its own employees.

N. The Contractor's employees, representatives, agents, and consultants, and all of its SubContractors' employees, representatives, agents, and consultants at the site are to refrain from using indecent language. All doing so will be removed from the site. Artwork or decoration found on vehicles belonging to the Contractor or the SubContractors' employees parked on or near the school property which contain indecent language or pictures shall either be covered or removed from the location.

O. The Contractor's employees, representative, agents, and consultants, and all of its SubContractors' employees, representatives, agents, and consultants at the site are to wear shirts, long pants, and proper footwear.

P. Each contractor shall keep the premises and surrounding area in which it is working free from accumulation of waste materials or rubbish caused by the performance of all of the work being performed on-site and in the buildings. On a daily basis at the conclusion of work on the Project, each contractor shall clean the areas in which it has performed work and shall remove all waste, materials, rubbish, its tools, construction equipment, machinery, and surplus materials. Each contractor shall broom sweep all construction areas in which it has performed worked every day. The Construction Manager shall perform an inspection each afternoon to determine that the work areas of the Contractors have been properly cleaned. In the event the work areas are not cleaned, the Construction Manager shall advise the offending contractor to provide cleaning as required herein. If any Contractor fails to keep the site safe and clean within four (4) hours of being notified by the Construction Manager, either verbally or in writing, the Construction Manager will have the clean-up work performed and back charged to the offending contractor without further notification to the Contractor. The cost of such cleaning company, together with the cost of any custodial costs of the School District, at prevailing overtime rates plus fifteen percent (15%) will be charged to the offending Contractor. Notice to field personnel shall be deemed notice to the Contractor.

Q. The Contractor shall provide ventilation of enclosed areas during construction as may be required to permit proper curing and drying out and to prevent excessive humidity, moisture, and condensation. Ventilation shall be by natural or artificial means as required by conditions involved.

R. The Contractor shall be responsible for the control of chemical fumes, gases, and other contaminates produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure that they do not enter occupied portions of the building or air intakes.

S. The Contractor shall be responsible for ensuring that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured, or ventilated in accordance with manufacturers' recommendations before a space can be occupied.

T. From the commencement to the completion of the Project, the Contractor shall keep the parts of the work and the buildings free from accumulation of water no matter what the source or cause of water.

U.

1. The General Contractor shall construct temporary partitions where shown on the Contract Documents or where otherwise required for safety of the public or to prevent dust from entering occupied areas. Partitions shall be dust-proof from floor to slab or structure above (if existing condition is a drop in tile ceiling, the Contractor shall remove tile and install partition to structure above). In addition to framing and sheetrock, the Contractor shall install fire resistant plastic partitions on the work area side of its work. If an access door is required, an alternating three-layer plastic system shall be used. The door shall be a standard hollow metal door with lockset and closer. Keys shall be distributed to the Owner's other contractors, the Owner, and the Architect.

2. All cutting and welding performed within an occupied building or adjacent to a window or intake vent shall be performed during off hours.

V.

1. The Contractor shall control the safe handling and storage of all welding materials, acetylene and oxygen tanks, and other equipment required for welding and cutting work at the job site. Such storage shall be in compliance with the Occupational Safety and Health Administration ("OSHA") regulations.

2. Welding materials and equipment shall be removed promptly from the premises upon completion of the welding and cutting work.

W. The Contractor shall be responsible for all costs incurred by the Owner caused by false security/fire alarms set off by the Contractor. Costs shall include custodial response charges etc.

X. The Contractor shall be responsible for broken glass, and at the completion of the Work shall replace such damaged or broken glass. After damaged or broken glass has been replaced, the Contractor shall remove all labels, wash and polish both sides of all glass. In addition to general broom cleaning, the General Contractor shall perform the following final cleaning for all trades at completion of the Work:

1. remove temporary protections;

2. remove marks, stains, fingerprints and other soil or dirt from painted, decorated and natural finished woodwork and other Work;

3. remove spots, plaster, soil and paint from ceramic tile, marble and other finished materials, and wash or wipe clean;

4. clean fixtures, cabinet work and equipment, removing stains, paint, dirt and dust, and leave same in undamaged, new condition;

5. clean aluminum in accordance with recommendations of the manufacturer; and

6. clean all floors thoroughly in accordance with recommendations of the manufacturer.

ARTICLE 5
SUBCONTRACTORS

A.

1. As soon as practicable after receipt of Letter of Intent to Award, Notice to Proceed or other form of official notice of award of the Contract, but not more than ten (10) days after receipt of official notice of award of the Contract, the Contractor shall furnish the Owner and the Architect, in writing, with: (1) the name, trade, and subcontract amount for each SubContractor; and (2) the names of all persons or entities proposed as manufacturers of the products identified in the Specifications (including those who are to furnish materials or equipment fabricated to a special design) and, where applicable, the name of the installing SubContractor. Copies of all SubContractor contracts, fully executed, are to be provided to the Construction Manager, including but not limited to all addenda, appendices, and/or exhibits including scope of work sheets. All such subcontracts shall be submitted to the Construction Manager within ten (10) days of the Owner's award of the contract to the Contractor.

2. Upon review of the Contractor's list of SubContractors, the Architect will advise the Contractor in writing stating whether or not the Owner, the Construction Manager or the Architect, after due investigation, accepts or rejects, any proposed SubContractor. SubContractors will not be acceptable unless, when requested by the Architect, evidence is furnished that the proposed subcontractor has satisfactorily completed similar subcontracts as contemplated under this prime contract, and has the necessary experience, personnel, equipment, plant, and financial ability to complete the subcontract in accordance with the intent of the Documents. As verification of financial ability, the Owner reserves the right to request and receive up to five (5) years' worth of financial statements, bank references, bond/insurance company references and all other information required to assess financial ability.

3. If the Owner, the Construction Manager, or the Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom

the Owner, the Construction Manager, and the Architect have no objection. No increase in the Contract Sum shall be allowed where a SubContractor is rejected by the Architect, the Construction Manager, or the Owner who is: (1) deemed unqualified to perform the particular work subcontracted by the Contractor; (2) does not have the necessary experience, personnel, equipment, plant, and financial ability to complete the subcontract; (3) has a history of poor performance in work of similar nature; or (4) does not otherwise meet the requirements of this General Conditions. Upon receipt of a rejection of a SubContractor by the Architect, the Contractor shall have the right to request a meeting with the Architect, the Construction Manager, and the Owner to discuss the reasons it believes the SubContractor is or is not qualified to perform the work. Upon review of such reasons, the Architect shall re-consider its determination and shall advise the Contractor of its determination upon such review. If the Architect still finds that such SubContractor does not meet the requirements above stated, it shall advise the Contractor. The Architect's determination upon such review shall be final and binding on the Contractor and its SubContractor and the Contractor hereby waives any and all claims it or its SubContractor might have against the Owner, the Construction Manager, and/or the Architect concerning the rejection of such Contractor and shall require its SubContractors to execute such similar waiver in its Agreement with the Contractor.

4. The Contractor shall not change a SubContractor, person, or entity previously selected if the Owner, the Construction Manager, or the Architect makes reasonable objection to such change.

B. By appropriate Agreement, the Contractor shall require each SubContractor to be bound to the Contractor by terms of the Contractor's Agreement with the Owner, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by said Agreement, assumes toward the Owner and the Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, the Construction Manager, and the Architect under the Contractor's Agreement with the Owner so that subcontracting thereof will not prejudice such rights, and shall allow the SubContractor, unless specifically provided otherwise in the subcontract Agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by its Agreement with the Owner, has against the Owner. However, the Subcontract Agreement between the Contractor and SubContractor shall not provide, nor shall this Agreement be deemed to provide any rights, remedies or redress by the SubContractor(s) against the Owner. Where appropriate, the Contractor shall require each subcontractor to enter into similar agreements with Sub-SubContractors.

C. The Contractor shall promptly notify the Owner, the Construction Manager, and the Architect of any material defaults by any SubContractors and/or whether it has terminated its Agreement with any of its subcontractors for any reason.

D. The Contractor hereby assigns all of its rights in its Agreements with its SubContractor(s) and hereby does assign, transfer, and set over to the Owner all of its rights and/or interests in its Agreements with its SubContractor(s), but only in the event of termination of the Contractor's Agreement with the Owner pursuant to Article 17, paragraph A of these General Conditions and only to the extent the Owner implements its rights to take such assignment of contract by

notifying the SubContractor in writing of its intention to do so. Such an assignment is subject to the prior rights of the surety, if any, obligated to the Owner pursuant to a performance bond submitted in connection with the Contractor's work.

E. If the Work in connection with a subcontract has been suspended for more than ninety (90) days after termination of the Contract by the Owner and the Owner accepts assignment of such subcontract, the SubContractor's compensation shall not be adjusted for any increase in direct costs incurred by such SubContractor as a result of the suspension.

F. It shall be the Contractor's responsibility, when subcontracting any portion of his work, to arrange or group items of work under particular trades to conform with then-prevailing customs of the trade, regardless of the particular Divisions and Sections of the Specifications in which the work is described.

G. All subcontracts must be in writing.

ARTICLE 6
CONTRACTOR'S USE OF DRAWINGS/SPECIFICATIONS

A. The Agreement between the Owner and the Contractor, and all documents incorporated therein by reference, including but not limited to, the Drawings and the Project Manual shall be signed by the Contractor and the Owner.

B. The intent of the Agreement between the Owner and the Contractor is to include all items necessary for the proper execution and completion of the work to be performed by the Contractor. The documents comprising the Agreement between the Contractor and the Owner are complementary, and what is required by one shall be as binding as if required by all.

C.

1. In the event of inconsistencies within or between parts of the Agreement between the Contractor and the Owner or between the Agreement between the Contractor and the Owner and applicable standards, codes, and ordinances, the Contractor shall (a) provide the better quality or greater quantity of Work or (b) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation.

2. On the Drawings, given dimensions shall take precedence over scaled measurements and large-scale Drawings over small scale Drawings.

3. Before ordering any materials or performing any of its work, the Contractor and each SubContractor shall verify measurements at the Project and shall be responsible for the correctness of such measurements. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference which may be found shall be submitted to the Architect for resolution before proceeding with the performance of the work.

4. If a minor change in the Work is found necessary due to actual field conditions, the Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

5. Drawings, in general, are made to scale, but all working dimensions shall be taken from the figured dimensions or by actual measurements at the job and in no case by scaling. The Contractor shall study and compare all drawings and verify all figures before laying out or constructing the work and shall be responsible for any and all errors in his work which might have been avoided thereby. Whether or not an error is believed to exist, deviation from the Drawings and the dimensions given thereon shall be made only after approval in writing is obtained from the Architect.

6. In the event addendum(a) are issued and contain changes to the Drawings and/or the Specifications, the provisions in the addendum(a) supersede previously issued Drawings and/or the Specifications.

D. Organization of the Specifications into divisions, sections, and articles, and arrangement of the Drawings shall not control the Contractor in dividing the work among the SubContractor or in establishing the extent of the Work to be performed by any trade.

E. Unless otherwise stated in the Agreement, words and abbreviations which have well-known technical or construction industry meanings are used in the Agreements in accordance with such recognized meanings.

F. The Contractor, and all SubContractors, shall refer to all of the Drawings, including those showing the work of others performing work in connection with the Project, including but not limited to the General Contractor (if any), the Plumbing Contractor, the Heating, Ventilation, Air Conditioning Contractor, Electrical Contractor and other specialized trades, and to all of the Divisions of the Project Manual, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results.

G. All indications or notations on the Drawings which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials, or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Drawings or the Project Manual. All work mentioned or indicated in the Drawings or the Project Manual shall be performed by the Contractor unless it is specifically indicated therein that the work is to be performed by others.

H. The Drawings, the Specifications, and other documents prepared by the Architect are instruments of the Architect's service through which the Contractor's work is to be performed. The Contractor may retain one contract record set during the course of the Project. Neither the Contractor nor any SubContractor, Sub-SubContractor or material or equipment supplier shall own or claim a copyright in the Drawings, the Specifications, and other documents prepared by the Architect, and unless otherwise indicated, the Architect shall be deemed the author of them and will retain all common law, statutory, and other reserved rights, in addition to the copyright.

All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work.

I. The Drawings, the Specifications, and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any SubContractor, Sub-SubContractor or material or equipment supplier on other Projects without the specific prior written consent of the Owner and the Architect. The Contractor, SubContractors, Sub-SubContractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, the Specifications, and other documents prepared by the Architect appropriate to and for use in the performance of its work pursuant to its Agreement with the Owner. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, the Specifications, and other documents prepared by the Architect. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

J. The Owner shall furnish surveys describing physical characteristics of the site, upon written request of the Contractor and to the extent such survey is in existence at the time of said request, legal limitations, and utility locations for the Project. Nothing herein shall be construed as requiring the Owner to generate any document which it does not possess at the time of the request by the Contractor. In the event that the survey provided does not clearly delineate the metes and bounds of the Owner's property, the Contractor shall stop work and immediately notify the Architect, the Construction Manager, and the Owner. The Contractor shall NOT proceed with its work until it receives written permission from the Construction Manager and/or the Architect. The Contractor shall be fully responsible for all costs arising from non-compliance with this provision. Any delays associated with this provision shall not serve as a basis for a claim by the Contractor.

K. From the basic data established by the Owner, the General Contractor shall establish reference control points and complete the layout of the work. Each contractor is responsible for utility markouts as it pertains to the scope of their work and maintaining markout during work. Sketch of layout with reference points to be given to the Construction Manager and the Architect at the time of markout.

L. The Contractor shall be responsible for all measurements that may be required for execution of the work to the exact position and elevation as prescribed in the Specifications, shown on the Drawings, or as the same may be modified at the direction of the Architect to meet changed conditions.

M. The General Contractor shall be responsible for the establishment of points, wall, and partition lines required by the various Prime Contractors and their respective SubContractors in laying out their work.

N. Each contractor shall furnish such stakes and other required equipment, tools, and materials, and all labor as may be required in laying out any part of the work from the base lines and benchmarks established by the Owner.

O.

1. The General Construction Contractor shall establish a baseline and benchmark system for each building addition, area of renovation or component using the services of a licensed professional surveyor. The surveyor(s) employed to establish this system or to extend and maintain an existing benchmark system for the work of other trades shall have not less than five (5) years of experience in performing construction surveys similar to the work they will perform for the Project. The remaining contractors and their respective subcontractors shall be responsible for extending these lines, levels, and grades, and for performing all layout for their own work. The Contractor is solely responsible for any damage or loss due to incorrect extension of lines, level, or grades in their layout. The Contractor and its SubContractors shall be responsible for the accuracy with respect to the layout of their work. Any discrepancies or errors in the Drawings, perceived by another contractor or subcontractor shall be immediately reported to the Construction Manager. If any corrections are necessary, they shall be executed in accordance with the terms and provisions of these General Conditions.

2. The Contractor and its SubContractors shall be responsible to offset or to protect their markings from anything that may disturb them.

3. Every contractor shall work off the lines and elevations established and maintained as the baseline and benchmark system.

4. Each contractor is responsible for the accuracy of his own work.

P. The Architect may require that construction work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking completed work or the work in progress.

Q. Except for the basic building permit, and other permits that the Architect may be required to obtain on behalf of the Owner, the Contractor shall be responsible for securing and maintaining for the life of the Project: all permits, P.E. Licenses, connection fees, inspections, etc. applicable to, or customarily secured for the work. This provision includes any permits to be issued in the name of the Contractor required for the work. Originals of all permits are to be issued in the name of the Contractor as required for the work. The Contractor shall furnish the Construction Manager with original copies of all permits prior to the commencement of the work, and shall prominently display a copy of all permits at a location approved by the Construction Manager.

R. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies, or omissions discovered shall be reported to the Architect in writing at once.

S. The exactness of grades, elevations, dimensions, or locations given on any drawings issued by the Architect, or the work installed by other contracts, is not guaranteed by the Architect or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, utilities, and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, locations, or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner.

T.

1. The Contractor shall give the Architect timely written notice of any additional design drawings, specifications, or instructions required to define its work in greater detail, or to permit the proper progress of its work. To the extent the Architect advises the Contractor that the Drawings, the Specifications and/or instructions given are sufficiently detailed for the Contractor to perform its work, the Architect shall be under no obligation to further clarify or define the work to be performed. In all other circumstances, the Architect shall issue a field order which responds to the request for information.

2. Requests for Information (RFIs) are for requests on clarifications or questions on the Drawings and/or the Specifications, not contract terms, scheduling items, or general correspondence nor, as a means to describe or request approval of alternate construction means, methods or concepts or substitution or materials, systems means and methods. The Contractor shall fill all RFIs out in accordance with the provisions of the Project Manual. Neither the Architect nor the Construction Manager shall fill said forms out on the Contractor's behalf.

U. The Contractor shall, prior to the start of any portion of the Work:

1. review any specified construction or installation procedures, including those as may be recommended by the proposed manufacturer;

2. advise the Architect if the specified procedure(s) deviates from good construction practice;

3. advise the Architect if following said procedure(s) will affect any warranty, including the Contractor's general warranty;

4. advise the Architect of any objections the Contractor may have to the specified procedure(s); and

5. propose any alternative procedure(s) which the Contractor will warrant.

V.

1. To the fullest extent possible, the Contractor shall provide products of the same kind, from a single source. When two or more items of same material or equipment are required (pumps, valves, air conditioning units, etc.), they shall be of the same manufacturer. Product

manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in the work, except as otherwise indicated. The Contractor shall provide products which are compatible within systems and other connected items. If the Contractor is given option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

2. The Contractor is responsible for providing products and construction methods compatible with products and construction methods of other Contractors. If a dispute arises between contractors over concurrently selectable but incompatible products, the Architect will determine which products shall be used.

3. With respect to sitework materials, all products submitted for use and incorporated into the Project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

4. All products submitted for use and incorporated into the Project shall be asbestos free.

W. Equivalents. In the Specifications, one or more kinds, types, brands, or manufacturers or materials are regarded as the required standard of quality and are presumed to be equal. The Contractor may select one of these items or, if the Contractor desires to use any kind type, brand, or manufacturer or material other than those named in the Specifications, they shall indicate in writing, and prior to award of contract, what kind, type, brand or manufacturer is included in the base bid for the specified item. The Contractor shall follow the submission requirements for substitutions as set forth in Article 6.X below.

X.

1. Substitutions. If the Contractor desires to substitute any kind, type, brand, or manufacturer of material other than those named in the Specifications, the Contractor shall indicate the desired substitution in its bid, including the following:

a. For which specified material or equipment the request for substitution is being made.

b. What kind, type, brand, or manufacturer is sought to be substituted for the specified items.

c. Written documentation evidencing that the substituted material or equipment meets or exceeds the Specifications for materials and/or equipment set forth in the Project Manual. Such documentation shall include, but not limited to, a full explanation of the proposed substitution, together with a submittal of all supporting data including technical information, catalog cuts, warranties, test results, installation instructions,

operating procedures, significant qualities of proposed substitution (*e.g.*, performance, weight, size, durability and visual effects), and other like information necessary for a complete evaluation of the substitution. Additionally, the Contractor shall provide material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. All such data shall be provided to the Architect and the Owner at the Contractor's sole expense. The Contractor's written explanation shall also include a list of reasons the substitution is advantageous and necessary, including the benefits to the Owner and the Project in the event the substitution is acceptable. Additionally, the Contractor shall submit to the Architect information describing in specific detail how the proposed substituted product differs from the quality and performance required by the Specifications, and such other information as may be required by the Owner or the Architect.

d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate proposed substitution.

e. Samples, where applicable or requested.

f. Detailed comparison of the Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

g. Detailed comparison of the difference in cost between the specified product and the proposed substitution, including any and all costs associated with changes or modifications needed to other parts of the work and to construction performed by the Owner and/or separate contractors that will be necessary to accommodate proposed substitution. In the event the substitution is accepted, the Contractor proposing the use of the substitution shall bear all costs associated with said changes or modifications.

2. By making said requests in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor:

a. represents that a representative of it has personally investigated the proposed substitute product and has determined that it is equal to or superior in all respects to that specified;

b. represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product;

c. certifies that the cost data is complete and includes all related costs under this contract, including professional services necessary and/or required for the Architect/Engineer to implement said substitution and waives any and all claims for additional costs related to the substitution which subsequently become apparent;

d. represents that it will coordinate the installation of the accepted substitute, making all such changes to the Drawings effected by the change, including but not limited to the electrical, plumbing, site work, and heating and ventilating specifications as may be required for the work to be complete in all respects;

e. will provide an affidavit stating that: (1) the proposed substitution conforms and meets all the requirements of the pertinent specifications and the requirements shown on the Drawings; and (2) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Architect; and the proposed substitution will have no effect on the construction schedule.

3. Proposals for substitutions shall be submitted with the Contractor's bid.

4. No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.

Y.

1. Submittal of shop drawings, product data, material safety data sheets, samples, or similar submittals shall be in accordance with the provisions of the Project Manual.

2. The Contractor represents and warrants that all shop drawings have been prepared by persons and entities possessing expertise and experience in the trade for which the shop drawing is prepared and, if required by the Architect or applicable law, by a licensed engineer, job specific, reviewed by the Contractor and stamped by the Contractor.

3. If the Contractor elects to perform its work without approvals, such work shall be at the Contractor's own risk and expense.

4. By approving and submitting shop drawings, product data, samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of its work.

5. The Contractor shall not be relieved of responsibility for deviations from requirements of its work by the Architect's approval of shop drawings, product data, samples, or similar submittals, unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors and/or omissions in the shop Drawings, product data, samples or other of its submittals to the Architect, by the Architect's approval thereof.

6. The Architect shall review, approve, reject, or take other appropriate action respecting submittals made by the Contractor as set forth in the Project Manual. The Architect shall check for conformance with information given in the Drawings and Project Manual and the design concept expressed in the Agreement between the Owner and the Contractor. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems designed by the Contractor, all of which remain the responsibility of the Contractor. Further, the Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of construction means, methods, techniques, sequences, or procedures.

The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon such certification to establish that the materials, systems, or equipment will meet the performance criteria required by the Contract Documents.

7. Upon the Architect's rejection of the Contractor's shop drawings, product data, samples, and/or other documentation submitted by the Contractor to the Architect, the Contractor shall review the rejection and re-submit such shop drawing, product data, sample and or other document in accordance with the Architect's instruction. The Contractor shall direct the Architect's specific attention in writing or on re-submitted shop drawings, product data, samples, or similar submittals, to revision which have been made, including revisions not specifically requested by the Architect. Resubmission of rejected documents shall be performed within two (2) calendar days. No claim for delay or cost shall be accepted as a result of rejected documents.

8. When professional certification of performance criteria of materials, systems, or equipment is required of the Contractor, the Architect shall be entitled to rely in a reasonable and professional fashion upon the accuracy and completeness of such calculations and certifications provided, however, if the Architect, in its reasonable and professional judgment considers it advisable, the Architect shall verify the accuracy and completeness of any and all such calculations and/or certifications. In the event any and all such calculations and/or certifications are found to be inaccurate and/or incomplete by the Architect, the Contractor shall assume full responsibility and bear all costs attributable or related thereto, including, without limitation, the expense of the Architect's additional services associated with the verification of such calculations and/or certifications and the expense of the Architect's additional service made necessary by the failure of such calculations and/or certifications to be accurate or complete.

9. If the Architect is required to review the Contractor's submittal more than twice, the Contractor shall bear the cost and expense associated with such additional review as set forth in the Project Manual.

Z. The Architect will interpret and decide matters concerning performance under and requirements of the Drawings and/or the Specifications on written request of the Contractor. Such interpretations may, at the Architect's option, be issued in the form of additional drawings or instructions indicating in greater detail the construction or design of the various parts of the Contractor's work. Such drawings or instructions may be forwarded by the Architect to the Contractor by field order, construction change directive or other notice to the Contractor. The Contractor shall execute the work for which it requested an interpretation in accordance with such additional drawings or instructions without additional cost or extension of its contract time. After a decision has been rendered by the Architect on a matter for which the Contractor sought the Architect's interpretation of the Drawings and/or the Specifications, the Contractor shall proceed with the work as directed by the Architect. Failure to proceed with the work in accordance with the Architect's interpretation may be used as a basis for termination of the Contractor's contract pursuant to Article 17 of these General Conditions.

AA. The Contractor shall maintain at the site one record copy of the Drawings, the Specifications, Addenda, Change Orders, and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved shop drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and the Construction Manager and shall be delivered to the Construction Manager for submittal to the Owner upon the completion of its work.

BB. The Contractor shall maintain at the site, and shall make available to the Owner, the Construction Manager, and the Architect, one record copy of the Drawings (the "Record Drawings") in good order. The record drawings shall be prepared and updated during the prosecution of the Contractor's work. The prints for record drawing use will be a set of black line prints provided by the Architect to the Contractor at the start of construction. The Contractor shall maintain said set in good condition and shall use colored pencils to mark up said set with "record information" in a legible manner to show: (i) deviations from the Drawings made during construction; (ii) details in the work not previously shown; (iii) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (iv) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings, and stub-outs, etc.; (v) architectural and/or structural changes in the design; and (vi) such other information as either the Owner or the Architect may reasonably request. At the completion of the work, the Contractor shall transfer all information on record drawings to reproducible drawings with new information clouded and noted. Such drawings shall be stamped with the Contractor's name and "AS-BUILT" in the lower right hand corner. The colored record drawing and the as-built reproducible drawing shall be forwarded to the Construction Manager for delivery to the Owner. Final payment and any retainage shall not be due and owing to the Contractor until the record and/or as built drawings receive the approval from the Architect and the Owner (and all other closeout requirements are met).

CC. The Contractor shall maintain all approved permit drawings in a manner so as to make them accessible to government inspectors and other authorized agencies. All approved drawings shall be wrapped, marked, and delivered to the Owner within sixty (60) days of final completion of the Contractor's work.

DD. Each Prime Contractor shall be furnished, free of charge, three (3) copies of the Contract Documents and Project Manuals, including all Addenda. Any and all additional copies will be furnished to the Contractor at the cost of reproduction, postage, and handling.

ARTICLE 7
CONTRACTOR'S SAFETY/SECURITY PROGRAM

A.

1. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of its work. Prior to beginning any work, the Contractor shall submit a copy of its corporate safety plan to the Owner and the Architect. Two (2) weeks after receipt of the Notice to Proceed, the Contractor shall provide a Site Safety/Logistics Plan to the Owner and the Architect. The site logistics plan should minimally include locations of the eight-foot high temporary fence and gates, traffic plans for deliveries and removals, refuse container locations, crane locations, pick locations, boom radium, and lift locations, stockpiles, toilet locations, site water and power locations, and safety. This plan shall also show the location of all staging and storage areas, clearly separating construction and school areas. The logistical information represented by the construction documents shall serve as a minimal guide. Each contractor is required to submit their corporate safety policy within ten (10) days of receipt of the Notice to Proceed. Said policy must minimally meet OSHA standards and define details concerning the maintenance of a safe work environment and shall also define practices for the maintenance of hygiene and minimizing the spread of infectious/contagious diseases. The Contractor shall make the participation of its SubContractors in its safety program mandatory. A list of key personnel, with addresses and telephone numbers for emergency purposes shall be forwarded to the Owner and the Architect. The Owner and the Architect shall establish a fire coordination procedure and shall forward same to the Contractor for its use during the performance of its work.

2. Where applicable, the Contractor shall provide its COVID-19 Safety Plan to the Owner prior to the start of any work. The Contractor shall designate a person on its staff to be responsible for monitoring the wearing of Personal Protective Equipment ("PPE") by each person on site working with or for the Contractor. The Contractor shall strictly follow and ensure that its SubContractors follow Contractor's COVID-19 Safety Plan, as well as all applicable Center for Disease Control guidelines and Local, State & Federal Orders.

3. All laborers, workers, and mechanics employed in the performance of the work of the Project shall be certified as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least ten (10) hours in duration.

4. The Contractor and its SubContractors shall conduct their operation in accordance with the Safety Guides for Construction as issued by the New York State Education Department ("NYSED"), and the Contractors' Safety Program.

5. All safety equipment, including hard hats and weather protective gear required for the Contractor to perform its work, are to be supplied by the Contractor and/or its SubContractors. Within the designated construction areas, the Contractor's employees, superintendents, and/or other agents, and its SubContractors, employees, superintendents, and/or other agents are required to wear hard hats and other required and/or essential safety equipment. Each person seen without a hard hat, or otherwise failing to comply with this requirement, will be ordered to leave the Project. No prior warnings will be given by the Owner, the Construction Manager, and/or the Architect. The Contractor and its SubContractors shall be solely responsible for making up and paying for any loss of production or required progress resulting from the removal of personnel from the Project as set forth herein including any costs incurred by the Owner in connection with the work of other contractors.

6. The Contractor and its SubContractors shall provide blankets and auxiliary fire protection as part of its construction safety program to prevent damage to adjacent work or materials as a result of its welding or burning operations. Additionally, as part of its construction safety program, the Contractor and its SubContractors shall provide a fire watch, with a fire extinguisher, which is acceptable to the Owner and the Construction Manager.

7. The Construction Manager and/or the Owner reserve the right to have all operating equipment periodically inspected by an independent inspector whose finding will be binding. The Contractor, at its own expense, must make corrections within two (2) working days of receiving a written report.

8. All flagmen required for deliveries to the site are to be furnished by the Contractor or its SubContractors responsible for the delivery. Any and all deliveries crossing the site or student traffic areas shall be escorted by flagmen. All flagmen shall wear orange vests.

B. The Contractor shall schedule weekly safety meetings and each of its SubContractors must be properly represented at such meetings. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. The Contractor shall notify the Construction Manager in writing of its "OSHA Competent Person Regarding Safety." Said person must be an individual capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. This person shall be the Contractor's Superintendent, unless otherwise designated by the Contractor in writing to the Construction Manager and the Architect. The Contractor shall take all necessary steps to prevent its employees from disturbing and/or damaging the facility and shall be responsible for preventing the escape of fires set in connection with the construction. The Contractor shall notify its employees and its SubContractors of the location of the nearest fire alarm box at all locations where the work is in progress. On a weekly

basis, the Contractor shall submit to the Construction Manager and the Architect minutes of its safety meetings, which minutes shall include a list of the individuals present at such meetings.

C. The Contractor and each of its SubContractors shall conduct its/their operation in accordance with all applicable federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies. The Contractor agrees, in order that the work will be completed with the greatest degree of safety to conform to the requirements of the Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, including all standards and regulations that have been since or shall be promulgated by the governmental authorities which administer such acts.

D. The Contractor shall give notices and comply with applicable federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies, of public authorities or governmental agencies bearing on safety of persons or property or their protection from damage, injury, or loss.

E. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for surety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

F. The Contractor shall take reasonable precautions for the safety and protection of employees at the Project and other person who may be affected by its work, including but not limited to students, staff, employees and agents of the Owner, the Construction Manager, and the Architect.

G. The Contractor shall protect and secure its work and the materials and/or equipment to be utilized in connection with its work, whether stored on or off the site and whether in its care, custody and control or that of its SubContractors, subcontractors to its subcontractors, or material suppliers.

H. The Contractor shall take all steps necessary to protect all property at or adjacent to the site, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

I. All delivery vehicles/trucks/machinery/etc. permitted on the site must be equipped with back-up alarms and enter through the designated access points. The Contractor's failure to demonstrate this ability will result in cancellation of delivery or stoppage of work. All delays associated with this cancellation will be the responsibility of the Contractor responsible for the work involved.

J. All crane picks, materials delivery, etc. must be coordinated so as not to lift over any occupied area of the building. If absolutely necessary, this work shall be done on off hours to ensure the safety of the building occupants. Crane location must be approved by the Construction Manager and the Owner in writing prior to the use of same to ensure the safety of building occupants.

K. The Owner or the Construction Manager reserves the right to have all hoisting equipment periodically inspected by an independent inspector whose findings will be binding. The Contractor, at its own expense, must make corrections cited by the inspector before continuing work. The Owner or the Construction Manager will not assume any responsibility for the safe operation of any hoisting equipment by exercising this right. The Contractor and/or its SubContractor(s) shall cooperate with the inspector by allowing time for the inspection. The Contractor shall be notified twenty-four (24) hours prior to the time of the inspection. These inspections do not release the Contractor if its responsibility to provide all engineering, permits and inspections as required by OSHA or the NYSED prior to use of any hoisting equipment.

L. The Contractor shall use the entrances designated on the site logistic plans and Drawings for personal vehicles, trucks, equipment, deliveries, and the like.

M. All interior temporary partitions and emergency egress barriers (if required) are to be installed on an after-hours basis (weekends/school holidays).

N.

1. When use or storage of hazardous materials or equipment or unusual construction methods are necessary to perform its Work, the Contractor shall obtain the Owner and the Construction Manager's consent for the use of such materials, equipment, or unusual construction methods. In the event the Owner determines that the use of such hazardous material or equipment or unusual construction methods can be performed by the Contractor with alternative means, methods and/or techniques, the Contractor shall employ such alternate means of prosecuting its work at no additional cost to the Owner.

2. In the event the Owner approves the use or storage of such hazardous materials, equipment or unusual construction methods, the Contractor shall provide for the Owner's and the Construction Manager's use a full set of safety instructions relating to all such materials. Additionally, when the Owner and/or the Construction Manager reviews the use of storage of such hazardous materials, equipment, and or unusual construction methods, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.

3. Transportation, storage, and use of explosives shall be in strict accordance with all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies. All safety precautions as set forth in the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, Inc. shall be observed.

4. The Contractor is responsible for its own storage and personnel trailers at the site. The Contractor will be required to supply man trailers and storage box trailers as required. All costs related to delivery, construction, protection, power, etc. for said trailers are the responsibility of the Contractor utilizing the space. The Owner WILL NOT PROVIDE STORAGE SPACE. The placement of personnel and/or storage trailer will be strictly limited to pre-

determined locations. The Contractor shall obtain the prior written approval of the placement of any trailer or storage box from the Construction Manager.

O. During construction, the General Contractor shall be responsible for maintaining a watertight structure. This shall include additions and existing buildings. The General Contractor shall be responsible for temporary roofing, tarps, and other protection at roofs, cavity walls, etc. Should the General Contractor fail to provide adequate protection, causing flooding, damage, or other disturbance to the existing building, the Contractor shall be responsible for all costs associated with clean up and repairs. Inasmuch as flooding and damage have safety implications to the general public, clean up, and repairs may be made by the Owner without warning to the General Contractor. Administration costs incurred by the Owner and Architect will also be back charged to the General Contractor. The General Contractor, by entering into contract with the Owner agrees to be liable for these costs.

P. When all or a portion of the Contractor's work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the work, as necessary, from injury or damage by any cause.

Q.

1. The Contractor shall promptly remedy damage and loss to all property of the Owner, or adjacent to the Owner's property (other than damage or loss covered by insurance) caused in whole or in part by the Contractor, a SubContractor, a Sub-SubContractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable, except damage or loss attributable to acts or omissions of the Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

2. Title to all completed or partially completed work at the job site, and to all materials delivered to and stored at said job site which are intended to become a part of the completed work covered by the Agreement between the Contractor and the Owner, shall be in the name of the Owner. Notwithstanding the foregoing, and prior to acceptance of the completed work by the Owner, the Contractor shall be liable for all loss of or damage to said completed work, partially completed work, materials furnished by the Contractor, and/or materials or equipment furnished by others, the custody of which has been given to the Contractor, arising from any cause other than those against which the Owner herein undertakes to carry insurance. In the event of loss or damage caused by the Contractor, the Contractor shall replace or repair same at its own cost and expense, to the satisfaction of the Owner, the Construction Manager, and the Architect.

R. The Contractor shall promptly report in writing to the Owner, the Architect, and the Construction Manager all accidents arising out of or in connection with the Work which cause death, person injury, or property damage, giving full details and statements or any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately by telephone or messenger to the Owner, the Construction Manager, and the Architect.

S. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss.

T. Any and all fines or citations levied against the Owner, the Architect, or the Construction Manager due to the failure of the Contractor to comply with regulations of any governing authority, shall be paid for by the Contractor. This shall include any interest or late charges which accrue due to the Contractor's failure to remit payment upon receipt of such levies.

U. The Contractor acknowledges that the Labor Law of the State of New York, and regulations adopted thereunder, place upon both the Owner and the Contractor certain duties and that liability for failure to comply therewith is imposed on both the Owner and the Contractor regardless of their respective fault. The Contractor hereby agrees that, as between the Owner and the Contractor, and to the extent permitted by law, the Contractor is solely responsible for compliance with all such federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies imposed for the protection of persons performing the Contract.

V. The Construction Manager, the Owner, and/or the Architect will not assume any responsibility for the safe operation of any cranes or equipment. The Contractor and its SubContractors shall cooperate with the inspector by allowing time for inspection. The Contractor will be notified twenty-four (24) hours prior to the time of the actual inspection. The Contractor is obligated to perform all engineering, obtain all permits (except as otherwise noted in Article 6(Q), and to have all hoisting equipment inspected as required by OSHA, Village, Town, County, State, and Federal regulations as well as any other agency having jurisdiction. Copies of all inspection reports and certificates must be transmitted to the Construction Manager as soon as possible.

ARTICLE 8
CHANGES IN THE WORK

A. Without invalidating the Agreement between the Owner and the Contractor, and without notice to the Contractor's surety, the Owner may, at any time or from time to time, order additions, deletions, or revisions in the Contractor's work. Such additions, deletions or revisions will be authorized by field order, change order, or construction change directive.

B. Field orders are an interpretation of the Drawings and/or the Specifications which order minor changes in the Contractor's work which will not result in an increase or decrease in the Contractor's total contract sum. From time to time, the Architect may issue field orders to the Contractor. The work included in such field order shall be performed by the Contractor at no additional cost to the Owner and shall not form the basis for a claim for an extension of time of the Contractor's time to complete its work. Hence, the Contractor shall perform the work included in field orders so as to cause no delay to its work and/or the work of other contractors engaged by the Owner in connection with the Project. All field orders shall be given to the Contractor and the Construction Manager by the Architect in writing.

C.

1. When the Owner or the Architect (in association with the Construction Manager) request that the Contractor perform work which is not included in the contract Drawings or the Specifications and which will result in additional cost to the Owner, the Architect/Construction Manager shall issue a PCO Number and shall request that the Contractor submit its proposal for performing such additional work. The Contractor shall submit its proposal to the Construction Manager and the Architect for review. The Contractor's proposal shall include a complete itemization of the costs associated with performing its work including labor and materials. All proposals for any work that a contractor, its subcontractor(s) or subcontractor(s) of subcontractor(s) perform in connection with additional work shall be submitted using the following format and in no event shall the total for overhead and profit (Contractor and SubContractor Costs) on any change order exceed fifteen percent (15%) of the cost of the work.

1.	Materials (Itemized Breakdown) including quantities and cost	
2.	Labor (Itemized Breakdown)	
3.	Subtotal (Add lines 1 and 2)	
4.	Credit for work not required due to additional or changes to the work reflected in the within change order (if any)	
5.	Overhead (10% x line 3)	
6.	Subtotal (Add lines 3 through 5)	
7.	Sub-Contract Work (Include itemized breakdown. Sub-Contractor(s) overhead and profit allowed is 10%)	
8.	Subtotal (Add lines 6 and 7)	
9.	Profit (5% x line 8)	
10.	Subtotal (Add lines 8 and 9)	
11.	Rental Value of Equipment (Itemized Breakdown)	
12.	Actual additional charges for bonds	
13.	TOTAL CHANGE ORDER (Add lines 10, 11 and 12)	

2. All proposals submitted by the Contractor without the itemization indicated herein will be returned to the Contractor for re-submission by the Contractor. For any work performed by the Contractor's own forces, fifteen percent (15%) for overhead and profit will be allowed for labor and material related costs. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall any change order proposal exceed fifteen percent (15%) of the cost of overhead and profit.

The Contractor shall not be entitled to recover overhead and profit on the rental value of equipment and machinery. "Equipment and machinery" shall not include: (1) tools customarily used by the Contractor's trade, including but not limited to hand tools; and/or (2) equipment and machinery already on site and being utilized by the Contractor for the original scope of work.

The Contractor shall submit with its change order proposals actual invoices from its insurance broker reflecting actual additional costs associated with the procurement of bonds.

3. The Contractor's SubContractor's proposal for any work it is to perform in connection with the additional work shall only include ten percent (10%) for the SubContractor's overhead and profit including sub-subcontracted work. The Contractor is entitled to five percent (5%) on work performed by its SubContractor in accordance with paragraph C(1) of this Article 8. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall the Contractor or the Contractor's SubContractor(s) be entitled to be reimbursed for overtime, except when specifically approved by the Owner in writing and not as an Extraordinary Measure as set forth in Article 13, and in such event the Contractor shall be paid for by the Owner on the basis of premium payment.

4. Notwithstanding the foregoing, work which is performed pursuant to an allowance included in the Contractor's base contract, the provisions of Article 9, paragraph B, concerning itemization of such work shall be controlling.

5.

a. A change in the Contract Sum shall be accomplished only by a written Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim as defined in Article 18 of these General Conditions to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents. **No amount shall be payable by the Owner to the Contractor for performance of work without a written and fully executed Change Order.**

b. Upon the Contractor's completion of the Change Order work, and prior to payment being made to the Contractor for such work, the Contractor shall provide the Owner with the following information:

(1) Certified payrolls itemizing the labor actually utilized in connection with the change order work.

(2) Copies of invoices from SubContractors supplying work in connection with the change order work.

D.

1. When the Owner or the Architect request that portions of the Contractor's work originally included in the Drawings or the Specifications be deleted and which will result in a reduction of the Contractor's original contract sum, the Architect shall request that the Contractor submit its proposal for deleting the scope of such work from its contract. The Contractor's proposal shall include a complete itemization of the costs associated with deducting such work including labor and materials and shall be submitted using the format set forth in Article 8, paragraph C(1) or the schedule of values, whichever is greater. The Contractor shall not be entitled to retain its overhead and/or profit for such work nor shall any of its SubContractors which were to perform the work being deducted from the Contractor's scope of work.

Additionally, the Contractor shall reflect the reduced cost of premiums on bonds which are to be supplied herein as a result of such change. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase/decrease with respect to that change.

2. The Owner may in its sole discretion deduct and/or reduce the scope of the Contractor's contract with or without any specific reasons therefor.

E.

1. In the event the Contractor and the Owner cannot agree on the sum by which its contract with the Owner is to be increased or reduced based upon changes to the scope of the work as described in this Article 8, the Architect shall issue a construction change directive reflecting the deduction and/or reduction of the scope of the Contractor's contract and the Contractor will (a) in the case of additional work to be performed by the Contractor, perform such additional work in an expeditious manner so as not to delay the work of this or other contractors working at the site, and (b) in the case of work to be deducted from the scope of the Contractor's work, refrain from taking any steps in connection with the work associated with the deduction and/or reduction of the scope of the Contractor's work. The construction change directive shall include (a) a description of the work being added or deducted from the Contractor's scope of work; (b) the amount the Owner has determined to be the cost associated with the additional work or deduction and/or reduction of the scope of the Contractor's contract until the Owner and the Contractor agree upon the increase or decrease in the Contractor's contract sum, or until a claim filed by the Contractor has been determined; (c) the extent to which the contract time will be adjusted as a result of the change in the scope of work. Any claims must be filed in accordance with the requirements set forth in Article 18 of these General Conditions. Failure to timely file any claim in accordance with requirements set forth therein shall constitute a waiver of such claim.

2. In the event the Contractor and the Owner reach Agreement on the amount by which the Contractor's contract sum is to be increased or decreased based upon changes to the scope of the Contractor's work as described in this Article 8, the Architect, the Owner, the Construction Manager, and the Contractor shall sign a change order reflecting such agreement. The change order shall include: (a) the description of the change in the scope of the Contractor's work; (b) the amount of the adjustment to the Contractor's contract sum, if any; and (c) the length of time by which the time to complete the contract will be adjusted, if any. Agreement between the Owner and the Contractor in connection with any change order shall constitute a final settlement of all matters relating to the change in the Contractor's work as reflected in said change order, including but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contractor's contract sum and the construction schedule. All such change orders for which the Owner and the Contractor have reached agreement shall be included as a separate line item in the Contractor's applications for payment as if originally part of the Contractor's agreement with the Owner.

F. Neither the Owner, the Construction Manager nor the Architect may issue instructions to the Contractor to change the amount of the Contract, except by properly executed Change Orders

or Construction Change Directive. Instructions are issued by the Owner or the Construction Manager through the Architect, to the Contractor. The instructions shall not be carried out by the Contractor prior to a written order in the form of a Change Order, signed by the Owner, the Architect and the Contractor, authorizing a change in the Contract amount or an adjustment to the Contract Sum. No amount shall be payable by the Owner to the Contractor for performance of work without an executed Change Order.

ARTICLE 9
PAYMENTS

A.

1. Prior to commencing its work on the Project and within one (1) week of receipt of a Notice to Proceed, the Contractor shall submit to the Construction Manager and the Architect, a schedule of values which includes the amount of money it has allocated in its bid price for the following items of work which are applicable to the Contractor's work. Said schedule of values shall include each of the CSI division sections reflected in the Specifications and applicable to the contract for which the Contractor has been awarded the contract, together with the requirements for bonds/insurance (based upon actual invoice amount), general conditions, meeting attendance and meeting documentation (at least two percent (2%) of the contract sum), shop drawing/product data/sample submissions (at least one percent (1%) of contract sum), labor and materials on line items as applicable, temporary utilities and services, HVAC balance reports, coordination drawings, punch list (at least one percent (1%) of the contract sum), warranties/guarantees and close out of the Project (at least three percent (3%) of the contract sum), and allowance, where applicable.

2. Any schedule of values which fails to include sufficient detail, is unbalanced or exhibits "front loading" of the value of the Contractor's work will be rejected. Furthermore, if the schedule of values has been approved by the Construction Manager and the Architect and is subsequently used, but later is found by the Construction Manager or the Architect to be improper for any reason, sufficient funds shall be withheld from the Contractors' future applications for payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor's work.

3. The schedule of values shall be drafted so as to reflect multiple construction sites, multiple locations within each site, additions versus renovations of work, and the like so as to satisfy any NYSED requirements for the Project.

4. The schedule of values prepared by the Contractor must be approved by the Construction Manager and the Architect prior to the payment of any sums due the Contractor.

B. The Contractor shall include in its contract sum all allowances stated in the Specifications. However, the Contractor's costs for unloading and handling at the site, overhead, profit, and other expenses contemplated for the stated allowance amounts shall be included in its contract sum and not in the allowances.

C. The Contractor shall submit its applications for payment to the Construction Manager and the Architect on a periodic basis. The form to be used by the Contractor shall be AIA G732 and 703/CMa approved by the Construction Manager, the Architect, and the Owner for use in connection with the Contractor's work. The form shall be divided in sufficiently in the same form as the Contractor's schedule of values and shall reflect in separate line items for the work:

1. Total value of the work listing labor and material separately.

2. Percentage of work completed at the time of submission of the application for payment.

3. Value of the work completed at the time of submission of the application for payment.

4. Percent of previous amount billed.

5. Previous amount billed.

6. Current percent completed.

7. Value of work completed to date.

8. Percent remaining to be completed by the Contractor.

9. Value of work remaining to be completed by the Contractor.

D.

1. Payments to the Contractor shall be based upon materials and equipment delivered and suitably stored at the site and/or incorporated into the Contractor's work, together with the labor utilized by the Contractor in connection with its work. The Contractor may be paid for materials and/or equipment which has been delivered to the Owner's facilities but which, at the time of submission of its application for payment, has not yet been incorporated into the Contractor's work upon such conditions and requirements as the Owner, the Construction Manager and/or the Architect may advise the Contractor it must satisfy.

2. The Construction Manager and the Architect shall review the application for payment submitted by the Contractor and shall advise the Contractor of any adjustments to be made thereto. The Construction Manager and/or the Architect may make such adjustments under the following circumstances:

a. the Contractor's failure to remedy defective work;

b. the filing of third-party claims or reasonable evidence that there is a probability that such claims will be filed;

c. receipt by the Owner of a notice of withholding from the New York State Department of Labor or other administrative agencies having jurisdiction over the Project;

d. the Contractor's failure to make proper payments to its SubContractors or material suppliers for labor, materials and/or equipment;

e. reasonable evidence that the Contractor will not complete its work for the unpaid balance of the remaining monies on its contract;

f. damages caused to the Owner, the Construction Manager, the Architect or another contractor as a result of the Contractor's performance of its work;

g. reasonable evidence that the Contractor will not complete its work in accordance with its Agreement with the Owner, and/or that the remaining monies available on the Contractor's contract will not be sufficient to cover actual or liquidated damages for the anticipated delay;

h. the Contractor's failure to carry out its work in accordance with the Drawings and/or the Specifications;

i. the Contractor's failure to notify the Architect of errors or inconsistencies between and among the Drawings and the Specifications;

j. the Contractor's and/or its SubContractors' failure to comply with the requirements for maintaining record drawings;

k. the Architect's and/or the Construction Manager's discovery or observation of work which has been previously paid for by the Owner which is defective and/or incomplete;

l. such other acts and/or omissions by the Contractor in connection with the performance of its work;

m. the amount requested exceeds the percent completion of work on the site.

3. After any such adjustments are made to the Contractor's application for payment, the Contractor shall submit four (4) copies of the final draft of its application for payment to the Construction Manager and the Architect, which shall be accompanied by the following documentation:

a. A current Contractor's lien waiver and duly executed and acknowledged sworn statement showing all SubContractors and material suppliers with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any SubContractor and

material suppliers in the requested progress payment and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such SubContractors and material suppliers;

b. Duly executed waivers of public improvement liens from all SubContractors and material suppliers and lower tiered SubContractors or material suppliers establishing payment or satisfaction of payment of all amounts requested by the Contractor on behalf of such entities or persons in any previous application for payment; and AIA Form G706 or G706A.

c. Certified payroll for employees of the Contractor and employees of SubContractors performing work on the Project.

d. Copies of invoices submitted to the Contractor by its SubContractors and/or material suppliers.

e. Such other information which the Owner, the Construction Manager and/or the Architect request the Contractor furnish in connection with its application for payment, including but not limited to, Contractor change order log, Contractor submittal log and as built drawings to date.

4. Upon submission of its application for payment, the Contractor represents that it is entitled to payment in the amount for which it seeks payment.

5. In addition to the right to make adjustments to the amount the Contractor claims is due (as set forth in subparagraph 2 of this Paragraph D), the Owner may withhold payment from the Contractor and the Architect and/or the Construction Manager may withhold certification for payment, if any of the reasons set forth in subparagraph 2 exist.

6. The Owner shall make payment to the Contractor within forty-five (45) days of receipt of the Contractor's requisition of payment unless such requisition of payment is not in accordance with the terms of the Construction Documents.

7. Upon receipt of payment by the Owner, the Contractor shall promptly make payment to each of its SubContractors and/or material suppliers for which it has received payment from the Owner. This provision does not obligate the Architect, the Construction Manager, and/or the Owner to ensure payment to the Contractor's SubContractors and/or material suppliers.

8.

a. In the event a subcontractor and/or material supplier files with the Owner a public improvement lien, the Owner shall withhold payment on previously certified applications for payment which have not yet been paid or subsequent applications for payment submitted by the Contractor an amount equal to one hundred fifty percent (150%) of the amount set forth in such public improvement lien. This provision is in addition to and does not supersede the indemnity provisions set forth in Article 12 of these General Conditions.

b. The Owner may release any payment withheld due to the filing of a public improvement lien if the Contractor obtains security acceptable to the Owner or a lien bond which is: (1) issued by a surety acceptable to the Owner; (2) in form and substance satisfactory to the Owner; and (3) in an amount not less the one hundred fifty percent (150%) of such lien claim. The cost of the premiums for any such bond posted shall be borne solely by the Contractor. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of its obligations pursuant to these General Conditions, including but not limited to the indemnity provisions set forth in Article 12 of these General Conditions.

E.

1. The Contractor shall not be entitled to payment for materials and/or equipment stored off the site unless previously approved in writing by the Owner, the Architect, and/or the Construction Manager and upon the Contractor meeting any and all conditions which the Owner, the Architect, and/or the Construction Manager may impose in connection with such materials and/or equipment, including but not limited to insurance for such materials and cost of storage and transportation associated with such materials and/or equipment. No payment will be made for "commodity type" stored materials such as block, studs, sheetrock, roofing, insulation, piping, fittings, conduit work, etc.

2. In connection with materials and/or equipment stored off the Project site, the Contractor must submit with its application for payment the following information:

a. Type of material must be specifically identified by the Contractor;

b. The Contractor must furnish an invoice from its supplier showing the total value of material and/or equipment being stored off site and must provide the bill of lading for such material and/or equipment;

c. The Contractor must provide a Certificate of Insurance in a form approved by the Owner for the full value of the item plus ten percent (10%).

d. The Contractor must execute a security agreement, together with an executed UCC-1 form;

e. The materials must be stored in a bonded warehouse;

f. The Contractor must furnish a bill of sale for stored material and/or equipment;

g. The Contractor still has liability for all materials whether paid or not until installed.

3. Any and all materials and/or equipment for which the Contractor has been paid shall be titled in the Owner upon installation by the Contractor and shall be stored in a bonded facility. For payment to be made to the Contractor, the Contractor must provide the Owner with a waiver of lien and general release from its supplier in connection with its provisions of such materials and/or equipment. Notwithstanding payment by the Owner, any and all warranties and/or guarantees required to be provided shall not begin to run until the Contractor has completed all of its work.

4. Prior to payment by the Owner, the Contractor may be required to provide the Architect and the Construction Manager with an opportunity to visually inspect the materials and/or equipment for the purpose of determining that such materials are in fact in storage, are the materials specified for the Contractor's work and for any other purpose which the Owner, Construction Manager, and/or the Architect deem necessary for payment to be made to the Contractor.

F. If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to its Agreement with the Owner, including but not limited to these General Conditions, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained herein to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to: (1) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contractor's contract sum by an amount equal to that which the Owner is entitled.

G. The Contractor may not assign any monies due or to become due to it pursuant to its Agreement with the Owner without the Owner's prior written consent. Any such assignment shall be in a form acceptable to the Owner. If the Contractor attempts to make such an assignment without such consent from the Owner, the Contractor shall nevertheless remain legally responsible for all obligations under its Agreement with the Owner.

H. Progress payments and all other payments shall be made in accordance with Section 106 (b) of the General Municipal Law.

I. At the same time the Contractor submits its insurance certificate to the Owner and the Construction Manager, it shall also submit to the Construction Manager the labor rates of each

category of labor for which it and/or its SubContractors shall employ (either directly or indirectly).

This information shall be itemized in the format shown below:

Contractor's Name					
Contractor's Address					
Contractor's Office Phone					
Contractor's Fax Number					
Contractor's Email Address					
Labor Rate Breakdown					
Worker's Title		**Journeyman**	**1.5 Rate**	**Foreman**	**1.5 Rate**
Base Hourly Rate					
Payroll Tax & Insurance:	**$ Per Hr.**				
FICA					
Federal Unemployment					
State					
Workers Compensation					
Disability					
Other (Explanation Required)					
Subtotal					
Benefits:	**$ Per Hr**				
Vacation					
Health & Welfare					
Pension					
Annuity					
401K Fund					
Other (Explanation Required)					
Other Explanation Required)					
Subtotal					
Hourly Labor Rate					

ARTICLE 10
INSURANCE REQUIREMENTS

A. Within ten (10) days of the award of the bid, the Contractor, at its sole cost and expense, shall provide the Owner with the following insurance coverage whether the operations to be covered thereby are through the Contractor or by a SubContractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

The insurance required to be procured pursuant to this Article shall be purchased from and maintained by an insurance carrier licensed and admitted to do business in the State of New York, with an AM Best rating of A-, VIII, or better. The Contractor must submit the Certificate of Insurance to the Construction Manager for the Owner's approval prior to the commencement of any work. EXCESS OR SURPLUS LINE INSURANCE CARRIERS WILL NOT BE ACCEPTED.

1. **Workers' Compensation, Paid Family Leave and NYS Disability Insurance**
   Statutory Workers' Compensation (C-105.2 or U-26.3), NYS Paid Leave and NYS Disability Insurance (DB-120.1) for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable. A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

2. **Commercial General Liability Insurance**
   $1,000,000 per Occurrence/$2,000,000 aggregate
   $2,000,000 Products and Completed Operations
   $1,000,000 Personal and Advertising Injury
   $100,000 Fire Damage
   $10,000 Medical Expense
   The general aggregate shall apply on a per-project basis.

3. **Owners Contractors Protective (OCP) Insurance**:
   For Projects less than or equal to $1,000,000 and work on 1 story (10 feet) only: $1,000,000 per occurrence, $2,000,000 aggregate with the Owner as the named insured.

   For Projects greater than $1,000,000 and/or work above one story (10 feet): $2,000,000 per occurrence, $4,000,000 aggregate with the Owner as the named insured.

   The Owner will be the named insured on OCP Policies. There will be no additional insureds on any OCP Policies.

4. **Automobile Liability**
$1,000,000 combined single limit for owned, hired, borrowed and non-owned motor vehicles.

5. **Umbrella/Excess Insurance**
$5,000,000 each occurrence and aggregate for general construction (including plumbing, electrical, and HVAC) and no work at elevation (<1 story or 10 feet) or Project values less than or equal to $1,000,000.

$10,000,000 each occurrence and aggregate for high-risk construction, work at elevation (>1 story or 10 feet) or Project values greater than $1,000,000.

Umbrella/Excess coverage shall be on a follow-form basis or provide broader coverage over the General Liability and Automobile Liability coverages.

6. **Asbestos/Lead Abatement/Pollution Liability Insurance**
If the Project requires the removal of asbestos and/or hazardous materials, the Contractor shall provide hazardous material liability insurance as follows:

$2,000,000 per occurrence/$2,000,000 aggregate, including products and completed operations. Such insurance shall include coverage for the Contractor's operations including, but not limited to, removal, replacement, enclosure, encapsulation and/or disposal of asbestos, or any other hazardous material, along with any related pollution events, including coverage for third-party liability claims for bodily injury, property damage and clean-up costs. If a retroactive date is used, it shall pre-date the inception of the Contract.

If the Contractor is using motor vehicles for transporting hazardous materials, the Contractor shall provide pollution liability broadened coverage (ISO endorsement CA 9948 or CA 01 12), as well as proof of MCS 90. Coverage shall fulfill all requirements of this Article 10 and shall extend for a period of three (3) years following acceptance by the Owner of the Certificate of Completion.

7. **Testing Company Errors and Omission Insurance**
$1,000,000 per occurrence/$2,000,000 aggregate for the testing and other professional acts of the Contractor performed under the Contract with the Owner.

B. Notwithstanding any terms, conditions, or provisions, in any other writing between the parties, the Contractor hereby agrees to effectuate the naming of the Owner, the Architect, and the Construction Manager as an additional insured on the Contractor's Commercial General Liability and Excess/Umbrella insurance policies.

1. The policies naming the Owner, the Architect, and the Construction Manager as named insured or additional insured, as applicable, shall:

a. be an insurance policy from an A.M. Best A- rated insurer, licensed and admitted to conduct business in New York State; and

b. state that the coverage shall be primary and non-contributory coverage for the Owner, its Board, employees, and volunteers with a waiver of subrogation in favor of the Owner for all coverages including Workers Compensation.

2. Additional insured status for General Liability coverage shall be provided by standard or other endorsements that extend coverage to the Owner for on-going operations (CG 20 38 or equivalent) and products and completed operations (CG 20 37 or equivalent). The decision to accept an alternative endorsement rests solely with the Owner. A completed copy of the endorsement must be attached to the certificate of insurance to include General Liability, Automobile Liability and Umbrella/Excess coverages.

3. The certificate of insurance must describe all services provided by the Contractor (e.g., roofing, carpentry or plumbing) that are covered by the liability policies.

4. At the Owner's request, the Contractor shall provide a copy of the declaration page of the liability and excess policies with a list of endorsements and forms. If so requested, the Contractor will provide a copy of the policy endorsements and forms.

5. There will be no coverage restrictions and/or exclusions involving New York State Labor Law statutes or gravity-related injuries.

6. No policies containing escape clauses or exclusions contrary to the Owner's interests will be accepted.

7. The Contractor agrees to indemnify the Owner, the Architect and the Construction Manager for any applicable deductibles and/or self-insured retentions.

If written on a "claims-made" basis, the retroactive date must pre-date the inception of the Agreement. Coverage shall remain in effect for three (3) years following the completion of work. The Contractor shall also provide proof of Workers' Compensation and New York State Disability Benefits Insurance, Commercial General Liability and Excess Liability with limits of $2,000,000 each occurrence and in the aggregate.

C. Coverages shall be maintained without interruption from the date of commencement of the work until the date of final payment and termination of any coverage required to be maintained after final payment.

D. The Contractor will be permitted to commence work on the Project with the insurance certificates currently on file with the Owner. On or before July 15 of each year, the Contractor will substitute said insurance certificates with insurance in strict compliance with Article 10. In addition to any other rights or remedies that the Owner may have in law, equity or pursuant to the General Conditions of Construction set forth in the Agreement between the Owner and the Contractor, in the event the Contractor fails to provide evidence of the insurance required by Article 10 by July 15, the Owner shall assess liquidated damages of $1,000.00 for every day the Contractor fails to meet the requirements for insurance as set forth in Article 10 through final completion of the Project or the date the required insurance is submitted, whichever is earlier.

E. All insurance coverage to be provided by the Contractor, pursuant to paragraph A of this Article 10, shall include a cancellation notice to the Owner pursuant to the policy terms and conditions. All insurance coverage to be provided by the Contractor shall name the Owner, the Architect, and the Construction Manager as additional insureds on the policy, with the exception of Owners Contractors Policies. Additionally, the insurance coverage to be provided by the Contractor, pursuant to paragraph A of this Article 10, shall state that the Contractor's coverage shall be the primary and non-contributory coverage for the Contractor's work. A fully completed New York Construction Certificate of Liability Insurance Addendum (ACCORD 855 2014/15) must be included with the certificates of insurance. For any "Yes" answers on Items A through L on this Form -- additional details must be provided in writing. Policy exclusions may not be accepted.

F. The Contractor acknowledges that its failure to obtain or keep current the insurance coverage required by paragraph A of this Article 10 shall constitute a material breach of Contract and subjects the Contractor to liability for damages, including but not limited to direct, indirect, consequential, special, and such other damages the Owner sustains as a result of such breach. In addition, the Contractor shall be responsible for the indemnification to the Owner, the Architect, and the Construction Manager, of any and all costs associated with such lapse in coverage, including but not limited to reasonable attorney's fees.

G. In the event that any of the insurance coverage to be provided by the Contractor to the Owner contains a deductible, or a self-insured retention, or the insurance provided by the Owner contains a deductible, the Contractor shall indemnify and hold the Owner and the Architect harmless from the payment of such deductible or self-insured retention, which deductible shall in all circumstances remain the sole obligation and expense of the Contractor. The failure of the Owner, Construction Manager or Architect to object to the contents of the certificate or the absence of same shall not be deemed a waiver of any rights held by the Owner.

H. SubContractors are subject to the same terms and conditions as stated above and must submit same to the Owner for approval prior to the start of any work. In the event the Contractor fails to obtain the required certificates of insurance from the SubContractor and a claim is made or suffered, the Contractor shall defend, indemnify, defend, and hold harmless the Owner, Construction Manager, the Architect, Engineers, Consultants, and Sub-consultants and their officers, members of the Board, agents or employees from any and all claims for which the

required insurance would have provided coverage. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.

I. The Contractor assumes responsibility for all injury or destruction of the Contractor's materials, tools, machinery, equipment, appliances, shoring, scaffolding, false and form work, and personal property of the Contractor's employees from whatever cause arises. Any policy of insurance secured covering the Contractor or SubContractors leased or hired by them and any policy of insurance covering the Contractor or SubContractors against physical loss or damage to such property shall include an endorsement waiving the right of subrogation against the Owner for any loss or damage to such property.

J. The Owner in good faith may adjust and settle a loss with the Contractor's insurance carrier.

K. The Owner and the Contractor waive all rights against each other and any of their SubContractors, Sub-SubContractors, agents, and employees for damages caused by fire or other perils to the extent of actual recovery of any insurance proceeds under any property insurance policy procured, pursuant to paragraph A of this Article 10, or other property insurance applicable to the Contractor's work.

L. Before commencement of its work, the Contractor shall obtain and pay for such insurance as may be required to comply with the indemnification and hold harmless provisions outlined under Article 12 of these General Conditions of the Contract for Construction.

M. If the terms of policies expire, or the lives of the insurance companies terminate, before the Contract is completed or during the period of completed operations coverage, and the Contractor fails to maintain continuance of such insurance, the Owner is entitled to provide protection for itself, to pay premiums, and to charge the cost to the Contractor.

ARTICLE 11
REQUIRED BONDS FOR THE PROJECT

A. Within ten (10) days of the award of the bid, the Contractor shall furnish a Performance Bond, Labor and Material Payment Bond and Maintenance Bond (to be in effect during the warranty period) meeting all statutory requirements of the State of New York.

B. All Surety companies are subject to the approval of the Owner and may be rejected by the Owner without cause.

C. Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment.

D. Bonds shall be executed by a responsible surety licensed to do business in New York with an A.M. Best Rating of "A-" or better as to Policy Holder Ratings, and "VIII" or better as to

"Financial Size Category." Such bonds shall remain in effect for a period not less than three (3) years following final completion of the work by the Contractor.

E. Bonds shall further be executed by a surety that is currently listed on the U.S. Treasury Department Circular 570 entitled "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies," as amended.

F. The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to one hundred percent (100%) of the Contract Sum. The value of each bond shall be adjusted during the Project construction period to reflect changes in the Contract Sum.

G. Every Bond must display the Surety's Bond Number.

H. Each bond must be accompanied by an original Power of Attorney, giving the names of Attorneys-in-fact, and the extent of their bonding capacity.

I. A rider including the following provisions shall be attached to each Bond:

1. Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change, or other modification of the Contract Documents. Such addition, alteration, change, extension of time, or other modification of the Contract Documents, or a forbearance on the part of either the Owner or the Contractor to the other, shall not release the Surety of its obligations hereunder and notice to the Surety of such matters is hereby waived.

2. Surety further agrees that in event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or Surety shall cause written notice of such default (specifying said default in detail) to be given to the Owner, and the Owner shall have thirty (30) days from time after receipt of such notice within which to cure such default, or such additional reasonable period of time as may be required if the nature of such default is such that it cannot be cured within thirty (30) days. Such Notice of Default shall be sent by certified or registered U.S. Mail, return receipt requested, first class postage prepaid, to Lender and the Owner.

3. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within three (3) years after termination by the Owner of the Contractor's contract or within three years after final completion by the Contractor. In the event the Contractor files for bankruptcy, the commencement of the three-year period shall not start to run until the bankruptcy proceeding is finalized or the Owner obtains relief from an automatic stay, whichever is later.

J. The Contractor shall deliver the required bonds to the Owner prior to beginning construction activity at the site, but no later than ten (10) days of issue date of Notice of Award of Contract. Said bonds shall be in the form set forth in the Project Manual. No work shall be performed by the Contractor until such bonds have been reviewed and approved.

K. The Owner may, in the Owner's sole discretion and without prior notice to the Contractor, inform surety of the progress of the Contractor's work and obtain consents as necessary to protect the Owner's rights, interest, privileges and benefits under and pursuant to any bond issued in connection with the Contractor's work.

L. If the surety on any bond furnished by the Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of this Article, the Contractor shall within ten (10) days thereafter substitute another Performance and Payment Bond and surety, both of which must be acceptable to the Owner.

ARTICLE 12
INDEMNIFICATION

A. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers and agents; and (3) the Construction Manager, its consultants, employees, officers and agents from and against any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses, including but not limited to attorney's fees, which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such contractor or any of its subcontractors or any person or firm directly or indirectly employed by such contractor, for the act(s) and/or omission(s) of any contractor or subcontractor in connection with the work of the Project.

B. To the fullest extent permitted by law, the Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of its work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction, of tangible property including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a SubContractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph B. The Contractor's indemnity obligations under this Paragraph B shall, but not by way of limitation, specifically include all claims and judgments which may be made against the Owner, the Architect, the Architect's consultants and agents and employees of any of them under any applicable statute, rule or regulation including the New York Statute, Occupational Safety and Hazardous Act, and the Federal Occupational Safety and Hazardous Act. In claims against any person or entity indemnified under this Paragraph B by an employee of the Contractor, a SubContractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Paragraph B shall not be

limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a SubContractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and its agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder which are incurred as a result of the Contractor's failure to give the notices required by Article 6(T) of these General Conditions of the Contract for Construction.

D. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers and agents from and against any actions, lawsuits, or proceedings or claims of liens brought against each or any of them as a result of liens filed against the Contractor's Project funds, including all the cost and expense of said liens, and including but not limited to attorney's fees incurred by each or any of them.

E. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any and all liability for violation of all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies applicable to the Contractor's work and shall defend any claims or actions which may be brought against the Owner as the result thereof.

F. The Contractor and its SubContractors shall defend, indemnify and hold harmless: (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any and all liability for claims made by third parties, including SubContractors, in connection with this Agreement and shall defend any claims or actions which may be brought against the Owner as the result thereof.

G. The Contractor shall defend, indemnify and hold harmless (1) the Owner, its consultants, employees, officers, members of the Board of Education, and agents; (2) the Architect and its consultants, employees, officers, and agents; and (3) the Construction Manager, its consultants, employees, officers, and agents from and against any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges, and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such contractor or any subcontractor or any person or firm directly or indirectly or indirectly employed by such contractor, with respect to violations of OSHA requirements, rules, and/or regulations.

H. The indemnification obligations set forth herein shall become effective upon the Owner, the Architect or the Construction Manager's receipt of a claim for which the Contractor is required to provide indemnification to the Owner, the Architect, or the Construction Manager. In the event that the Contractor shall fail to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor. In the event the Owner, the Architect, or the Construction Manager is required to bring an action to enforce the indemnification obligations set forth herein, the Contractor shall be liable to the Owner, the Architect, and/or the Construction Manager for all costs associated with said action including attorney's fees.

ARTICLE 13
TIME FOR COMPLETION OF WORK

A. The date of commencement of the Contractor's work shall be as indicated in the Agreement between the Contractor and the Owner. The date shall not be postponed or extended by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible to act. Time limits stated in the Agreement between the Owner and the Contractor are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

B. The Contractor shall not commence work on the site until two certified copies of all insurance policies and bonds required by Articles 10 and 11 of these General Conditions are provided to the Owner and accepted by the Owner. The date of commencement and/or completion of the Contractor's work shall not be changed by the effective date of such insurance. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the acceptance of the insurance and bonds required by Article 10 and Article 11 of these General Conditions.

C. The Contractor shall proceed expeditiously with adequate forces and shall achieve substantial completion of the work in accordance with the schedule set forth in the Agreement. The Contractor shall cooperate with the Owner, the Architect, the Construction Manager, and other contractors on the Project, making every reasonable effort to reduce the contract time.

D.

1. In the event the Owner determines that the performance of the Contractor's work, as of a milestone date, has not progressed or reached the level of completion required by its contract, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation: (1) working additional shifts or overtime; (2) supplying additional manpower, equipment, facilities; and/or (3) other similar measures (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the Contractor progresses its work in compliance with the stage of completion required by the Agreement with the Owner. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

2. The Contractor shall not be entitled to an adjustment in its contract sum in connection with Extraordinary Measures ordered by the Owner under or pursuant to Paragraph D(1).

3. The Owner may exercise the rights furnished the Owner under or pursuant to Paragraph D(1) as frequently as the Owner deems necessary to ensure that the Contractor's performance of its work will comply with any Milestone Date or completion date set forth in the Contractor's Agreement with it.

4. The Owner reserves the right to withhold payment from the Contractor until such time as the Contractor submits a daily schedule showing work to be again on schedule with the Construction Schedule and/or until its work is being installed according to the Project construction schedule, without additional cost to the Owner.

E. The Contractor shall achieve substantial completion of its work in accordance with the schedule for the work set forth in the Project Manual included as part of the Agreement with the Owner. Milestone Dates are dates critical to the Owner's operations that establish when a part of the work is to commence or be complete. All Milestone Dates are of the essence and shall have the same meaning as Substantial Completion for the purpose of Liquidated Damages in this Article 13.

F. Substantial completion shall be achieved by the Contractor when the Contractor has completed ninety-eight percent (98%) of its work. Work remaining to be completed after substantial completion shall be limited to items which can ordinarily be completed within the period between the payment at the time of substantial completion and final payment.

G.

1. The Project is to be physically completed in accordance with the time limits set forth in the Agreement between the Owner and the Contractor and as further set forth in the Project Manual and/or bidding documents. Liquidated damages will be assessed in the amount of One Thousand Two Hundred Fifty Dollars ($1,250.00) for each and every calendar day after such time allowed for completion.

2. The Contractor realizes that time is of the essence on this Contract and the completion date and milestone date for each work item in its Agreement, a Milestone Date reflected on the Project schedule, or the date of substantial completion of the Contractor's work shall be no later than the date indicated therein. In the event the Contractor fails to complete any work or substantially complete the work under this contract by said schedule date, the sum per calendar day for each date not met, as delineated above, will be subtracted from the payment due the Contractor (or, if the amount due the Contractor as payment is insufficient, any deficiency shall be paid by the Contractor to the Owner), except in cases where the Contractor has applied for and been granted an extension of time in accordance with the provisions of this Article 13.

3. The said sum per calendar day shall constitute the Liquidated Damages incurred by the Owner for each day of delay beyond the agreed upon dates of substantial completion. Such

Liquidated Damages shall be in addition to any other damages (other than by reason of delay) the Owner may incur as a result of the Contractor's breach of contract. In the event that substantial completion of its work is not achieved in accordance with the Project schedule, inspections will be performed once each week unless the Owner or the Architect determines, at their sole discretion, that additional inspections are not needed. All costs incurred by the Owner, the Construction Manager, and the Architect and the cost of additional inspections, at the rate of One Thousand Two Hundred Fifth Dollars ($1,250.00) per inspection, will be subtracted from payment due the Contractor. If the amount due the Contractor for payment is insufficient, any deficiency shall be paid by the Contractor to the Owner.

H.

1. Within five (5) calendar days from the occurrence of same, the Contractor must apply in writing to the Owner, the Architect or the Construction Manager for an extension of time to complete its work where it has been delayed as a result of: unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including acts of God, acts of the public enemy, acts of the federal or state government in either their sovereign or contractual capacities, fires, floods, pandemics, epidemics, quarantine restrictions, priority or allocation orders duly issued by the federal government; and/or freight embargoes. The Contractor may not apply for an extension of time for delays in acquisitions of materials other than by reason of freight embargoes. All other delays of the Project, including but not limited to, the Architect's review and/or approval of shop Drawings and/or submittals, requests for information, clarifications, samples, and change orders; Owner schedule; Architect certification of payment; payment by the Owner of the Contractor's application for payment; coordination amongst contractors; unavailability of materials and/or equipment; surveying/testing; closeout, etc. are deemed to be foreseeable and, therefore shall not form the basis for a claim for an extension of time by the Contractor.

2. All claims for additional time shall be supported by documentation which demonstrates to the Architect's and the Construction Manager's satisfaction that the critical path of the Work has been significantly altered by the delays to the activities in question, and that the schedule cannot be maintained by re-ordering other activities within the Project at no cost. Upon receipt of the Contractor's request for an extension of time, the Owner will ascertain the facts and extent of the delay, and may, in its sole discretion, extend the time for completion of the Contractor's work when in its judgment such an extension is justified. The Owner's determination will be final and binding in any litigation commenced by the Contractor against the Owner which arises out of the Owner's denial of an extension of time to the Contractor. Any approval of an extension of the Contractor's time to complete its work shall be memorialized by written change order, signed by the Owner, the Contractor, the Architect, and the Construction Manager. Where the Owner determines that the Contractor will be granted an extension of time, such extension shall be computed in accordance with the following:

> For each day of delay in the completion of its work, the Contractor shall be allowed one day of additional time to complete its contract. The Contractor shall not be entitled to receive a separate extension of time for each one of several causes of delay operating

concurrently; only the actual period of delay as determined by the Owner or its Architect may be allowed.

3. The Owner reserves the right to delay the commencement of Work or to otherwise modify the construction schedule set forth in the bid documents in order to comply with applicable federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies related to the COVID-19 pandemic. Contractor's remedies for any schedule modifications or delays caused directly or indirectly by the COVID-19 pandemic shall be an extension of time only, as further delineated in Article 13(H)(4), below.

4. Notwithstanding anything to the contrary in the Contract Documents, an extension in the contract time, to the extent permitted under this Article 13(H), shall be the sole remedy of the Contractor for any: (1) delay in the commencement, prosecution, or completion of the Work; (2) hindrance or obstruction in the performance of the Work; (3) loss of productivity or acceleration; (4) supply chain delays; or (5) other similar claims (collective referred to herein as "delay(s)"), unless a delay is caused by the Owner's active interference with the Contractor's performance of the Work, and only to the extent such acts continue after the Contractor furnishes the Owner with three (3) days' written notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any delay, including, but not limited to, consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, but not limited to, ordering changes in the Work, or directing suspension, rescheduling or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, shall not be construed as active interference with the Contractor's performance of the Work.

ARTICLE 14
DEFICIENT AND INCOMPLETE WORK

A. The Owner, through the Architect or the Construction Manager, will have the authority to reject work performed by the Contractor which does not conform to the requirements of the Drawings and/or the Specifications.

B. The Owner, through the Architect or the Construction Manager, shall have the authority to require additional inspection or testing of the Contractor's work whether or not such work is fabricated, installed, or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, its SubContractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the work to have performed additional inspection or testing of the work.

C.

1. If a portion of the Contractor's work is covered contrary to the Architect's request or to requirements specifically expressed in the Drawings and/or the Specifications, upon request by the Architect or the Construction Manager, the Contractor shall uncover such work for the Architect's or any governmental authority's observation and be replaced at the Contractor's sole expense without change in the Contract Time or Contract Sum.

2. If a portion of the Contractor's work has been covered which the Architect or any governmental authority has not specifically requested to observe prior to its being covered, the Architect or any governmental authority may request to see such work and it shall be uncovered by the Contractor. If such work is in accordance with the Drawings and/or the Specifications, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor, at its sole cost and expense, shall uncover and replace such work.

D. The Contractor shall promptly correct work rejected by the Owner, through the Architect or the Construction Manager, which fails to conform to the requirements of its contract with the Owner, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. The Contractor shall bear the all costs of correcting such rejected work, including but not limited to the cost of said additional testing and/or inspection, the cost of the Architect's services incurred in conjunction with such additional testing, and any cost, loss or damages to the Owner resulting from such actions. If prior to the date of Substantial Completion, the Contractor, a SubContractor or anyone for whom either is responsible uses or damages any portion of the Work or premises, including, without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

E. If the Contractor: (1) fails to correct work which is not in accordance with the requirements of its Agreement with the Owner; or (2) fails to carry out its work in accordance with the requirements of its Agreement with the Owner; or (3) fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment so as to be able to complete the work within the contract time; or (4) fails to remove and discharge (within ten (10) days) any lien filed upon the Owner's property by anyone claiming by, through, or under the Contractor; or (5) disregards the instructions of the Architect, the Owner or the Construction Manager, the Construction Manager, on behalf of the Owner may order the Contractor to stop its work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. This right shall be in addition to, and not in restriction of, other rights the Owner may have pursuant to these General Conditions or at law.

F.

1. If the Contractor defaults or neglects to carry out its work in accordance with its Agreement with the Owner and fails within a three (3) day period after receipt of written notice from the Construction Manager to commence and continue correction of such default or neglect

with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect, the Construction Manager and the Owner and such other consultants whose participation is deemed necessary by the Architect, for additional services and expenses made necessary by such default, neglect, or failure. Such action by the Construction Manager, including the amounts to be charged to the Contractor as a result of such action are subject to the prior approval of the Owner. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2. Where the Contractor's default and/or neglect to carry out its work in accordance with its Agreement with the Owner threatens the health, safety and/or welfare of the occupants of the School District's facilities and/or threatens the structural integrity and/or preservation of the School District's facilities, the Owner may proceed to carry out the Contractor's work upon twenty-four (24) hours' notice of its intention to do so to the Contractor.

G. If the Owner prefers to accept work which is not in accordance with the terms and conditions of the Agreement between the Owner and the Contractor, the Owner may, in its discretion, accept such work and reduce the Contractor's contract sum accordingly.

ARTICLE 15
FINAL COMPLETION AND CLOSEOUT OF THE PROJECT

A.

1. When advised by the Construction Manager that the Contractor's work is near substantial completion, the Architect shall visit the site to determine whether the Contractor's work is substantially complete. If the Architect's observations of the Contractor's work discloses any item which has not been performed in accordance with the requirements of the Drawings and/or the Specifications and/or which has not been completed to the point indicated in Article 13(F) of these General Conditions, the Contractor shall complete or correct such items upon receipt of notification from the Architect that a deficiency exists. The Architect shall not issue a certificate of substantial completion for the work of the Contractor until the work has been completed in accordance with Article 13(F). Upon completion of the work outlined by the Architect to it in accordance with this paragraph A(1), the Contractor shall advise the Architect of the need for an inspection of the work. If the Architect is required to inspect the Contractor's work more than twice, the Contractor shall be liable to the Owner for cost of the services performed by the Architect or the Construction Manager as a result of additional inspections.

2. Upon determining that the Contractor's work has progressed to the point of Substantial Completion, the Architect shall prepare a punch list of the Contractor's work which shall include only minor items of work remaining to be performed by the Contractor to bring its work into compliance with the requirements of the Drawings and/or the Specifications. The Contractor shall proceed promptly to complete and correct items on the punch list issued by the Architect and shall complete said items within thirty (30) days of its receipt of the punch list from

the Architect. At the time of substantial completion, the Owner shall retain two hundred percent (200%) of the value of the punch list items from the Contractor's remaining contract sum. The value of said remaining work shall be determined by the Architect. Upon completion of the work reflected in the final punch list, the Owner shall release the monies withheld pursuant to this paragraph to the Contractor.

3. The Architect's failure to include an item of deficiency on the punch list issued to the Contractor shall not relieve the Contractor of its responsibility to perform its work in accordance with the Drawings and/or the Specifications.

B.

1. If within three (3) years after the date of Substantial Completion of the Contractor's work or designated portion thereof, or after the date for commencement of warranties established pursuant to these General Conditions, or by terms of in applicable special warranty required by the Agreement between the Owner and the Contractor, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner, unless the Owner has previously given the Contractor a written acceptance of such condition. This period of three (3) years shall be extended with respect to portions of the Contractor's work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of such work. The obligation set forth hereunder shall survive acceptance by the Owner of the Contractor's and/or termination of the Contractor's Agreement with the Owner. The Owner shall give such notice within a reasonable period of time after discovery of the condition.

2. The Contractor shall, within a reasonable time after receipt of written notice thereof, but in no event no later than seventy-two (72) hours after receipt of such notice, commence to correct, repair, and make good any defects in its work.

3. The obligations of the Contractor pursuant to this paragraph shall cover any repairs to or replacement of work affected by the defective work.

4. In the case of any work performed in correcting defects pursuant to this paragraph, the guarantee periods specified herein shall begin anew from the date of acceptance by the Owner of such work.

C. Upon receipt of written notice from the Construction Manager that the Contractor's work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Contractor's work acceptable pursuant to the terms and conditions of its Agreement with the Owner and the Contract fully performed and upon receipt of the closeout documentation required by the Contract Documents and elsewhere in the Agreement between the Owner and the Contractor, the Architect will certify to the Owner that the Contractor is entitled to final payment on the Project.

D.

1. Prior to receipt of final payment from the Owner, the Contractor shall provide to the Architect the close out documentation required by the Contract Documents.

2. The Contractor shall schedule a close out meeting with the Architect and the Construction Manager for the purpose of delivering the close out documents required pursuant to the Contract Documents and elsewhere in the Agreement between the Owner and the Contractor.

E. If the Contractor's work is not accepted by the Owner after final inspection and additional time is required to complete items identified during the final inspection, the date starting the warranty periods described in the Contract Documents shall be set by the Architect at his discretion.

F. If the Architect is required to perform more than one final inspection because the Contractor's work fails to comply with the requirements of the contract, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the final payment to the Contractor.

G. Acceptance of final payment by the Contractor, a SubContractor or material supplier shall constitute a waiver of claims by that payee except those claims previously made in writing in accordance with the terms of Article 18 hereof and identified by that payee as unsettled at the time of final Application for Payment.

H. The Contractor shall submit all documentation identified in this section within ninety (90) days from the date of Substantial Completion. If the documentation has not been submitted, the Owner will obtain same through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by the Owner in securing such documentation.

ARTICLE 16
RELEVANT STATUTORY PROVISIONS

A. The Contractor shall at all times observe and comply with all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies, in any manner affecting the work and all such orders decreed as exist at present and those which may be enacted later, by bodies or tribunals having jurisdiction or authority over the work, and in addition to any other indemnification set forth herein, the Contractor shall indemnify and save harmless the Owner, and its officers, members of the Board, agents, or servants against any claim or liability arising from, or based on, a violation of any such law, ordinances, regulation, order or decree, whether by its or by its employees or agents.

B. The Contractor and each of its SubContractors shall comply with prevailing wage rates as issued by the of New York State Department of Labor for the location and duration of the Project and shall comply with all requirements governing its payments to its employees as set forth in Labor Law, Section 220, *et seq.* of the New York State Labor Law.

C. The Contractor and each of its SubContractors shall post a notice at the beginning of the performance of every public work contract on each job site that includes the telephone number and addresses for the Department of Labor and a statement informing laborers, workers, or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her particular job classification.

D. The Contractor specifically agrees, as required by Labor Law, Sections 220 and 220-d, as amended, that:

1. No laborer, workman or mechanic in the employ of the Contractor, SubContractor or other person doing or contracting to do the whole or any part of the work contemplated by the Contract, shall be permitted or required to work more than eight (8) hours in any one calendar day or more than five (5) days in any one week, except in the emergencies set forth in the Labor Law.

2. The wages paid for a legal day's work shall not be less than the prevailing rate of wages as defined by law.

3. The minimum hourly rate of wages to be paid shall not be less than that stated in the Project Manual, and any re-determination of the prevailing rate of wages after the Contract is approved shall be deemed to be incorporated herein by reference as of the effective date of re-determination and shall form a part of this Contract. The Labor Law provides that the Contract may be forfeited and no sum paid for any work done thereunder on a second conviction for willfully paying less than:

a. the stipulated wage scale as provided in Labor Law, Section 220, Subdivision 3, as amended; or

b. the stipulated minimum hourly wage scale as provided in Labor Law, Section 220-d, as amended.

E. The Contractor specifically agrees, as required by the provisions of the Labor Law of New York, Section 220-E, as amended that:

1. In the hiring of employees for the performance of this contract or any subcontractor hereunder, no contractor, subcontractor, nor any person acting on behalf of such contractor or sub-contractor shall by reason of sex, race, creed, color, disability, or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates.

2. No contractor, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, color, creed, sex, disability, or national origin.

3. There may be deducted from the amount payable to the Contractor a penalty of fifty dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the Contract.

4. This Contract may be canceled or terminated by the Owner and all monies due or to become due hereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract.

F. The Contractor shall comply with all of the provisions of the Immigration Reform and Control Act of 1986 and regulations promulgated pursuant thereto and shall require its SubContractors to comply with same. In addition to the other indemnification obligations set forth herein, the Contractor shall and does hereby agree to defend, indemnify, and hold harmless the Owner, the Owner's agents, officers, members of the Board, and its employees from and against any penalties, fees, costs, liabilities, suits, claims, or expenses of any kind or nature, including reasonable attorney's fees, arising out of or resulting from any violation or alleged violation of the provisions of said laws in connection with the work performed hereunder.

G. This Contract shall be void if the Contractor fails to install, maintain, and effectively operate appliances and methods for the elimination of harmful dust when a harmful dust shall have been identified in accordance with Section 222-a of the Labor Law of the State of New York.

H. The Contractor shall ensure that absolutely no asbestos containing material is used in conjunction with the performance of its work. The Contractor bears the sole responsibility to provide assurances that no asbestos containing material is built into the construction, or that any equipment used in the construction contains any asbestos containing material. If asbestos containing material is found, at any time during or after the construction is completed, it shall be the responsibility of the Contractor who installed said material to remove it and replace it with new non-asbestos containing material, as per federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies.

I. Large and small asbestos abatement projects as defined by 12 N.Y.C.R.R. 56 shall not be performed while the building is occupied. As referenced in this section, the term "building" shall mean a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion, and ventilation systems must be physically separated and sealed at the isolation barrier. Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and windows is provided. Work must be scheduled so that classes are not disrupted by noise or visual distraction.

J. Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturb surfaces that contain lead shall have in the Specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning, and clearance testing which are in general accordance with the HUD Guidelines.

K. As set forth in Article 4(M), no smoking is allowed anywhere on school property per New York State and County law. Violators are subject to a $1,000.00 fine and/or banishment from the property.

L. Applicable codes and standards for material furnished and work installed shall include all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies having jurisdiction, and applicable requirements of following codes and standards, including but not limited to:

1. New York State Uniform Fire Prevention and Building Code, and amendments thereto.

2. New York State Energy Conservation Construction Code.

3. State Education Department Manual of Planning Standards.

4. New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials, latest edition.

5. Life Safety Code - NFPA.

M. Wherever in the Specifications reference is made to ANSI or ASTM Standards, Federal Specifications, Consumer Product Standards, or similar recognized standards, the latest edition of the respective publishing agency in effect at the date of "Bid Issuance" shall be accepted as establishing the technical requirements for which compliance is required.

N. The Owner shall be entitled to request that the Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions of its Agreement in the event: (1) an order for relief is entered on behalf of the Contractor pursuant to Title 11 of the United States Code; (2) any other similar order is entered under any other debtor relief laws; (3) the Contractor makes a general assignment for the benefit of its creditors; (4) a receiver is appointed for the benefit of its creditors; or (5) a receiver is appointed on account of its insolvency. Failure to comply with such request within ten (10) days of delivery of the request shall entitle the Owner to terminate the Contract in accordance with Article 17 hereof. In all events, pending receipt of adequate assurance of performance and actual performance in accordance therewith, the Owner shall be entitled to proceed with the Contractor's work with its own forces or with other contractors on a time and material or other appropriate basis, the cost of which will be back charged against the Contractor.

O. The Contractor shall maintain policies of employment as follows:

1. The Contractor and the Contractor's SubContractor shall not discriminate against any employee or applicant for employment because of race, creed, color, disability, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their age, race,

creed, color, national origin, citizenship or immigration status, sexual orientation, gender identity or expression, military status, sex, disability, predisposing genetic characteristics, marital status, familial status, status as a victim of domestic violence, pregnancy-related condition, prior arrest or conviction record, or political opinion or affiliation. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

2. The Contractor and the Contractor's SubContractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, citizenship or immigration status, sexual orientation, gender identity or expression, military status, sex, disability, predisposing genetic characteristics, marital status, familial status, status as a victim of domestic violence, pregnancy-related condition, prior arrest or conviction record, or political opinion or affiliation.

3. The Contractor and the Contractor's SubContractors shall certify under penalty of perjury, that:

a. it is registered with the New York State Department of Labor pursuant to Section 220-i of the New York Labor Law; and

b. each of the subcontractors engaged by the Contractor for this Project are also registered.

c. The Contractor shall include with its certification, a copy of the Certificate(s) of Registration issued by the Commissioner of the Department of Labor for the Bidder and each of its subcontractor(s).

ARTICLE 17
TERMINATION OR SUSPENSION

A.

1. The Owner may terminate the Contractor's Agreement in the event the Contractor:

a. refuses or fails to supply sufficient skilled workers or suitable materials or equipment to complete the Work in a diligent, efficient, timely, workmanlike, skillful, and careful manner;

b. refuses or fails to correct deficient work performed by it;

c. fails to make prompt payments to SubContractors for labor, materials, and/or equipment in accordance with the respective agreements between the Contractor and the SubContractors;

d. disregards all federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies of public authorities or governmental agencies having jurisdiction;

e. disregards the instructions of the Architect, the Construction Manager or the Owner (when such instructions are based on the requirements of the Contract Documents);

f. is adjudged a bankrupt or insolvent, or makes a general assignment for the benefit of the Contractor's creditors, or a trustee or receiver is appointed for the Contractor or for any of its property, or files a petition to take advantage of any debtor's act or to reorganize under bankruptcy or similar laws; or

g. breaches any warranty made by the Contractor under or pursuant to the Contract Documents.

h. fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents; or

i. fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under the Contract Documents.

j. fails to keep the Project free from strikes, work stoppages, slowdowns, lockouts, or other disruptive activity;

k. or otherwise does not fully comply with the Contract Documents.

2. When any of the above reasons exists, the Owner may, without prejudice to any other rights or remedies, terminate employment of the Contractor upon three (3) days' written notice and may, subject to any prior rights of the surety:

a. take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

b. take possession of materials stored off site by the Contractor;

c. take assignments of the Contractor's SubContractors in accordance with these General Conditions;

d. finish the Work by whatever reasonable method the Owner may deem expedient.

3. When the Owner terminates the Contract for one of the reasons stated in Article 17(A)(1), the Contractor shall not be entitled to receive further payment until the completion of the Contractor's work. If the Owner's costs to complete the Contractor's work, including the expenses incurred by the Owner in connection with the services of the Architect, the Construction Manager and/or other consultants, exceed the contract balance remaining on the Contractor's contract, the Contractor shall be liable to the Owner for such excess costs. This provision shall survive termination of the Contractor's Agreement with the Owner.

B.

1. In addition to the Owner's right to carry out the work of the Contractor pursuant to the Agreement with the Contractor, the Owner may at any time, at will and without cause, terminate any part of the Contractor's work or all of the Contractor's remaining work for any reason whatsoever by giving three (3) days' written notice to the Contractor, specifying the portion of the Contractor's work to be terminated and the effective date of termination.

2. Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due it:

a. Cease operation as specified in the notice.

b. Place no further orders and enter into no further subcontracts for materials, labor, services, or facilities except as necessary to complete continued portions of the Contract.

c. Terminate all subcontracts and orders to the extent they relate to the Work terminated.

d. Proceed to complete the performance of the remaining work on its contract which has not been so terminated.

e. Take actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated Work.

3. The Contractor shall continue to prosecute that portion of its work which has not been terminated by the Owner pursuant to this paragraph. If the Contractor's work is terminated, the Owner shall not be liable to the Contractor by reason of such termination, except that the Contractor shall be entitled to payment for the work it has properly executed in accordance with the Agreement and prior to the effective date of termination (the basis for such payment shall be as provided in the Contract) and for costs directly related to work thereafter performed by the Contractor in terminating such Work, provided such work is authorized in advance by the Architect and the Owner in writing. No payment shall be made by the Owner, however, to the

extent that such work is, was, or could have been terminated under the Contractor's Agreement with the Owner.

4. In case of a termination pursuant to this paragraph B, the Owner will issue a Construction Change Directive or authorize a Change Order, making any required adjustment to the Date of Substantial Completion and/or the sum of contract monies remaining to be paid to the Contractor. The Owner shall be credited for: (1) payments previously made to the Contractor for the terminated portion of the Work; (2) claims which the Owner has against the Contractor under the Contract; and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract Sum; multiplied by fifteen percent (15%) representing the Contractor's overhead and profit.

5. For the remaining portions of the Contractor's work which have not been terminated pursuant to this paragraph B, the terms and conditions of the Contractor's Agreement with the Owner shall remain in full force and effect.

6. Upon termination of the Contractor's work or a portion of the Contractor's work pursuant to this paragraph B, the Contractor shall recover as its sole remedy, payment for work which it has properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, overhead and profit related to work terminated by the Owner pursuant to this paragraph B.

C.

1. In addition to the Owner's right to suspend, delay, or interrupt the Contractor from proceeding with any portion of its work pursuant to the terms and conditions of its Agreement with the Owner, the Owner may at any time, at will and without cause suspend, delay, or interrupt any part of the Contractor's work or all work for any reason whatsoever for such period of time as the Owner may determine by giving three (3) days' prior written notice to the Contractor, specifying that portion of the Contractor's work which is to be suspended, delayed, or interrupted, and the effective date of such suspension, delay, or interruption, as the case may be.

2. The Contractor shall continue to prosecute that portion of its work which has not been suspended, delayed, or interrupted, and shall properly protect and secure the portion of its work so suspended, delayed, or interrupted.

3. The Owner shall incur no liability to the Contractor by reason of such suspension, delay, or interruption except that the Contractor may request an extension of its time to complete its work in accordance with Article 13 hereof.

D. The Contractor agrees and acknowledges that payments for the work have been obtained through obligations or bonds which have been sold after public referendum. In the event the work is suspended or canceled as a result of the order of any court, agency, department entity, or

individual having jurisdiction, or in the event the work is suspended or canceled due to the fact that a court, agency, department, entity, or individual having jurisdiction has issued an order, the result of which is that the aforesaid obligations or bonds are no longer available for payment for the work, the Contractor expressly agrees that it shall be solely entitled to payment for work accomplished until a notice of suspension or cancellation is served upon it. The Contractor expressly waives any and all rights to institute an action, claim, cause of action or similar for any damages it may suffer as a result of the suspension or cancellation of the Work and/or its contract pursuant to this section.

ARTICLE 18
CLAIMS AND DISPUTES

A. Definition. A "Claim" is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other

disputes and matters in question between the Owner and the Contractor arising out of or relating to the Contract.

B. Time Limits on Claims. Claims by the Contractor must be made within thirty (30) days after occurrence of the event giving rise to such Claim, or within thirty (30) days after the claimant first recognizes the condition giving rise to the Claim, whichever is earlier. An additional Claim made after the initial Claim has been decided by the Owner will not be considered unless submitted in a timely manner. Failure of the Contractor to give timely notice of claim shall constitute waiver of the claim. Claims must be made by written notice to the Construction Manager, the Architect, and the Owner. The responsibility to substantiate Claims shall rest with the Contractor.

C. Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

D. Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are: (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents; or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then written notice by the Contractor shall be given to the Owner and the Architect promptly before conditions are disturbed and in no event later than five (5) days after first observance of the conditions; and (3) in the case of a condition at the site which involves a hazardous or toxic substance, as those terms are defined by OSHA or AHERA, written notice to the Owner, the Construction Manager and the Architect shall be given immediately upon discovery of such hazardous or toxic substance. The Architect and/or the Construction Manager will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend

an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Contractor in writing, stating the reasons.

E. Claims for Additional Cost. If the Contractor wishes to make a Claim for an increase in the Contract Sum as a result of a Change in the Work pursuant to Article 8 of these General Conditions, written notice as provided in this Article 18 shall be given before proceeding to execute the Work.

F. Claims for Additional Time. If the Contractor wishes to make Claim for an increase in the Contract Time, the Contractor shall comply with the requirements set forth in Article 13(H).

G. Nothing contained in the Contract Documents shall relieve the Contractor from compliance with any statutory requirement, including, but not limited to those contained in Education Law Section 3813.

ARTICLE 19
MISCELLANEOUS PROVISIONS

A. The Agreement between the Owner and the Contractor shall be governed by the law of the place where the Project is located; venue to be in the County in which the Project is located.

B. Historical lack of enforcement of any federal, state, and local laws, ordinances, regulations, rules, codes, orders, and policies shall not constitute a waiver of Contractor's responsibility for compliance with such law in a manner consistent with its Agreement with the Owner unless and until the Contractor has received prior written consent for the waiver of such compliance from the Owner and the Agency responsible for the enforcement of such law.

C. All notices to be given hereunder shall be in writing and may be given, served, or made: (1) by depositing the same for first class mail delivery in the United Stated mail addressed to the authorized representative of the party to be notified; (2) by depositing the same in the United Stated mail addressed to the authorized representative of the party to be notified, postpaid and registered or certified with return receipt requested; (3) by depositing the same for overnight delivery (prepaid by or billed to the party giving notice) with the United States Postal Service or other nationally recognized overnight delivery service addressed to the authorized representative of the party to be notified; or (4) by delivering the same in person to the said authorized representative of such party. Notice deposited in the mail by certified mail or overnight delivery in accordance with the provisions hereof shall be effective from and after the fourth (4th) day next following the date postmarked on the envelope containing such notice, or when actually received, whichever is earlier. All notices to be given to the parties hereto shall be sent to or made at the addresses set forth hereinbelow. By giving the other parties at least seven (7) days' written notice thereof, the parties hereto shall have the right to change their respective addresses and specify as their respective addresses for the purposes hereof any other address in the United States of America.

D. Except as expressly provided in the Agreement between the Owner and the Contractor, duties and obligations imposed by such Agreement and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law, or in equity or by other Agreement, and such rights and remedies shall survive acceptance of the Contractor's work and/or any other termination of the Contractor's Agreement with the Owner.

E. No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

F. The headings denoting the separately numbered Articles of these General Conditions are specifically set forth for reference purposes only and are not in any way to be deemed explanatory of or limiting of the contents of any paragraph or subparagraph. Furthermore, said headings are not to be deemed part of this Agreement for purposes of interpretation, litigation or as defining or limiting the rights or obligations of the parties.

G. In case any provision of this Agreement should be held to be contrary to, or invalid, under the law of any country, state or other jurisdiction, such illegality or invalidity, shall not affect in any way, any other provisions hereof, all of which shall continue, nevertheless, in full force and effect in any country, state, or jurisdiction in which such provision is legal and valid.

H. The rights stated in these General Conditions and the documents which form the Agreement between the Owner and the Contractor are cumulative and not in limitation of any rights of the Owner at law or in equity.

I. The Owner shall not be responsible for damages or for loss of anticipated profits on work not performed on account of any termination of the Contractor by the Owner or by virtue of the Owner's exercise of its right to take over the Contractor's work pursuant to its Agreement with the Contractor.

J. The Owner shall not be liable to the Contractor for punitive damages on account of its termination of the Contractor or any other alleged breach of the Agreement between it and the Contractor and the Contractor hereby expressly waives its right to claim such damages against the Owner.

K. The Contractor hereby expressly waives any rights it may have in law or in equity to lost bonding capacity as a result of any of the actions of the Owner, the Architect, or the Construction Manager taken in connection with the Contractor's work on the Project.

L. Upon determination by legal means (*e.g.*, court action, etc.) that termination of Contractor pursuant to Article 17.A.1 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Article 17.B.1 and Contractor's remedy for such

termination shall be limited to the recovery of the payments permitted for termination for convenience as set forth in Article 17.B.1.

M. As between the Owner and the Contractor:

1. Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

2. Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and

3. After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to warranties provided in accordance with its Agreement with the Owner, the date of any correction of work performed by the Contractor or failure to correct its work, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or the Owner, whichever occurs last.

N.

1. The Owner may occupy or use any completed or partially completed portion of the Contractor's work at any stage when such occupancy is authorized by public authorities having jurisdiction over the Project.

2. Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of the Contractor's work, nor does it waive the Owner's right to liquidated damages. Further such occupancy alone shall not determine when Substantial Completion and performance has been reached.

3. Immediately prior to such partial occupancy or use, the Owner, the Contractor, and the Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Contractor's work, and in order to prepare a complete punch list of omissions of materials, faulty workmanship, or any items to be repaired, torn out or replaced.

O. The Contractor agrees not to assign, transfer, convey, or sublet or otherwise dispose of this Contract or his right, title, and interest therein or his power to execute such Contract, to any other person, firm, or corporation without the previous consent in writing of the Owner.

P. The Owner is a tax exempt organization and will take title to materials used in the Project in order to permit tax exemption.

Q. The Owner will furnish a certificate with the Owner's Tax Exemption Number to the Contractor for use in purchasing tangible personal property required for the Project.

R. This exemption shall not apply to machinery, equipment, tools, and other items purchased, leased, rented, or otherwise acquired for the Contractor's use even though the machinery, equipment, tools, or other items are used either in part or entirely on the Work. This exemption shall apply only to materials fully incorporated into the Work of the Contract as accepted and approved by the Architect.

S. The Contractor shall, upon request by the Owner, furnish a bill of sale or other instrument indicating the quantities and types of materials purchased directly by the Contractor or SubContractor for incorporation into the Work. Upon delivery of the materials to the site, the Contractor shall mark or otherwise identify the materials to be incorporated into the Work. This exemption shall apply only to materials so identified and accepted.

END OF GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

SECTION 01 1000
SUMMARY OF CONTRACTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to all Sections of the specifications.

1.2 PROJECT

A. Project Name: Seely Place ES & Greenville ES Interior Renovations & Site Improvements.

B. Name: Edgemont Union Free School District.

C. Architect's Name: Fuller and D'Angelo, P.C.

1.3 DEFINITIONS

A. Refer to Article 1, General Conditions.

1.4 CONTRACT DESCRIPTION

A. Contract Type: Multiple prime contracts each based on a Stipulated Price as described in Form of Agreement.

B. Contract Type: Multiple contracts are separate contracts, representing significant construction activities, between Owner and separate contractors. Each contract is performed concurrently and coordinated closely with construction activities performed on Project under other contracts. Contracts for this Project include the following

1. Contract #1 General Construction (including asbestos abatement)
2. Contract #2 Plumbing
3. Contract #3 Mechanical
4. Contract #4 Electrical
5. Contract #5 Site

C. The work of each Contractor is identified in this Project Manual and on the Drawings.

D. Local custom and trade-union jurisdictional settlements do not control the scope of Work included in each prime contract. The Contractor shall only employ labor on the project or in connection with its work capable of working harmoniously with all trades, crafts and any other individuals associated with the capital improvement work to be performed. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, the affected prime contractor shall ensure thats its work continues uninterrupted during the pendency of such dispute. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, the affected prime contractor shall promptly negotiate a reasonable settlement to avoid or minimize the pending interruption and delays.

E. If it becomes necessary to refer to the contract documents to determine which prime Contract includes a specific element of required work, begin by referring to the prime Contracts, themselves; then, if a determination cannot be made from the prime Contracts, refer, in the following order, to the General Conditions, if any, this section of the Specifications, followed by the other Division-l sections and finally with the Drawings and other Sections of the Specifications.

F. If, after referring to the contract documents, it cannot be clearly determined which prime Contractor will perform a specific item of required work, then, that item of work will be brought to the Construction Manager's attention in writing for determination.

G. Summary by References: Work of the contract can be summarized by reference to the Contract, General Conditions, Instructions to Bidders , Specification Sections, Drawings, or Addenda issued subsequent to the initial printing of this Project Manual, and including but not necessarily limited to printed material referenced by any of these. It is recognized that the work of the Contract is unavoidably affected or influenced by governing regulations, natural phenomenon, including weather conditions, and other forces outside the contract documents.

1.5 RELATED REQUIREMENTS

A. Agreement Form: Contract Sum, retainages.

B. General Conditions : Additional requirements for progress payments and Changes in the Work.

C. Section 01 1000 - Summary of Contracts for Sequence of Work.

D. Section 01 1010 - Milestone Schedule.

E. Section 01 2000 - Price and Payment Procedures.

F. Section 01 2100 - Allowances.

G. Section 01 3553 - Site Safety and Security Procedures.

H. Section 01 5000 - Temporary Facilities and Controls.

I. Section 01 5500 - Vehicular Access and Parking.

J. Section 01 5713 - Temporary Erosion and Sediment Control

K. Section 01 7000 - Execution.

L. Section 01 7900 - Demonstration and Training

M. Section 01 9113 - General Commissioning Requirements

1.6 JURISDICTIONAL DISPUTES

A. To the extent that there is an appearance of an issue of work being performed by the wrong trade, the issue should be raised during the bidding process in writing as a request for clarification for the Architect and Construction Manager to respond to in writing, in the form of an addendum.

B. Each Contractor shall only employ labor on the project or in connection with its work capable of working harmoniously will all trades, crafts and any other individuals associated with the capital improvement work to be performed. There shall be no strikes, picketing, work stoppages, slowdowns or other disruptive activity at the project for any reason by anyone employed or engaged by the Contractor to perform its portion of the work. There shall be no lockout at the project by the Contractor. The Contractor shall be responsible for providing the manpower required to proceed with the work under any circumstance. Should it become necessary to create a separate entrance for a contractor involved in a labor dispute, all costs associated with creating that entrance shall be borne by the contractor involved in the dispute. Such costs shall include, but not be limited to, signage, fencing, temporary roads and security personnel as deemed necessary by the Owner for the safety of the occupants of the site.

C. If the Contractor has engaged the services of workers and/or subcontractor who are members of trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Owner, Architect, and Construction Manager, any conflict between its agreement with the Owner and any agreements or regulations of any kind at any time in force among members or councils which regulate or distinguish what activities shall not be included in the work of any particular trade.

D. The Contractor shall ensure that its work continues uninterrupted during the labor dispute and will be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes or strikes

1.7 SUBCONTRACTORS/SUPPLIERS

A. Submittal of Primary Sub Contractors and Suppliers include but not limited to the following:

1. Construction Contractor:

a. Asbestos Abatement

b. Excavation.

c. Concrete.

d. Pipe Material and equipment

e. Concrete Supplier

f. Pre cast structure supplier.

g. Roofing.

h. Steel Doors and Frames.

i. Hardware Supplier and Installer.

j. Gypsum Wallboard Assemblies

k. Acoustical Tile.

l. Resilient Flooring

m. Painting

B. Plumbing Contractor:

1. Pre cast structure supplier.
2. Plumbing equipment/Suppliers.
3. Piping.
4. Insulation

C. Mechanical Contractor:

1. Mechanical Equipment/Suppliers.
2. Ductwork.
3. Piping.
4. Insulation
5. ATC.

D. Electrical Contractor:

1. Conduit and devices.
2. Fire Alarm Sub Contractor
3. Switchboard/Panelboards.
4. Lighting Fixture Supplier.

E. Site Contractor

1. Excavation.
2. Concrete.
3. Pipe Material and equipment
4. Concrete Supplier
5. Pre cast structure supplier.
6. Asphalt Supplier

1.8 DESCRIPTION OF ALTERATIONS WORK

A. Scope of removal work is .

B. Scope of alterations work is indicated on drawings.

C. Plumbing: Alter existing system and add new construction, keeping existing in operation.

D. Mechanical: Alter existing system and add new construction, keeping existing in operation.

E. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.

F. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.

G. Security System: Alter existing system and add new construction, keeping existing in operation.

1.9 Edgemont Union Free School District will remove and re-install the following items before start of work:

A. Loose furniture, computers, loose books etc.

1.10 OWNER OCCUPANCY

A. Edgemont Union Free School District intends to continue to occupy adjacent portions of the existing building during the entire construction period.

B. Edgemont Union Free School District intends to occupy the Project upon Substantial Completion.

C. Edgemont Union Free School District intends to occupy a certain portion of the Project prior to the completion date for the conduct of normal operations.

D. Cooperate with Construction Manager to minimize conflict and to facilitate Edgemont Union Free School District's operations.

E. Contractors shall not stop work during the Owner's occupancy unless so directed by the Construction Manager or Architect.

F. Contractors should refer to Article 5 of the General Conditions concerning the Contractor's Construction Procedures.

G. The Contractor shall perform its work and conduct its operations so as not to disturb or interfere with the Owner's occupancy or its normal operations.

H. Additionally, bidders should be referred to Article 4 of the General Conditions concerning Contractor's Use of the Site.

1.11 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings. Refer to Article 4 of the General Conditions for requirements concerning Contractors use of the site.

B. Arrange use of site and premises to allow:

1. Edgemont Union Free School District occupancy.

2. Work by Others.

3. Work by Edgemont Union Free School District.

4. Use of site and premises by the public.

C. Provide access to and from site as required by law and by Edgemont Union Free School District:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

2. Do not obstruct roadways, sidewalks, or other public ways without approval by the Construction Manager's.

D. Existing building spaces may not be used for storage unless approved by the Construction Manager's.

E. Time Restrictions.

F. Contractors shall comply with Local Noise Ordinance. Work disrupting the community must be performed with the following hours:

G. Construction deliveries shall not occur during the hours of 7:30 AM and 9:00 AM and 2:00 PM and 3:00 PM, when school buses are arriving or leaving the school grounds.

H. During the entire construction period the Prime Contractors shall have the use of the premises for construction operations, including use of the site as indicated in Sequencce of Work and work time included in this section.

1. General: Limitations on site usage as well as specific requirements that impact utilization are indicated on the drawings and/or by other contract documents. In addition to these limitations and requirements, the Prime Contractors shall administer allocation of available space equitably among the separate prime or sub and other entities needing access and space, so as to produce the best overall efficiency in performance of the total work of the project. Each Prime Contractor shall schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

2. Prime Contractors shall limit their use of the premises to the work indicated, so as to allow for Owner occupancy and use by the public during the period when the Owner occupies the building.

3. Prime Contractors shall maintain clear and unobstructed paths of exit discharge from all existing exits.

4. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, Owner's Representative, Owner's employees, emergency vehicles, and public at all time. Do not use these areas for parking or storage of materials.

5. Lock automotive type vehicles such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

I. Only materials and equipment, which are to be used directly in the work, shall be brought to and stored on the project site by the Contractor. After equipment is no longer required for the work, it shall be promptly removed from the project site. Protection of construction materials and equipment stored at the

project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractors.

J. Site work shall be scheduled and coordinated with Construction Manager . The Owner decisions shall be final and binding on all contractors.

1. Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction

K. The Contractor(s) and any entity for which the Contractor(s) is responsible, shall not erect any sign on the Project site without the prior written consent of the Construction Manager which may be withheld in the sole discretion of the Owner.

L. Contractor shall ensure that the work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, each contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of:

1. Any areas and buildings adjacent to the site of the work or;

2. The Building in the event of partial occupancy .

M. Without prior approval of the Construction Manager, each Contractor shall not permit any workers to use any existing facilities at the Project site, including, without limitations, lavatories, toilets, entrances and parking areas other than those designated by the Construction Manager. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with the rules and regulations promulgated by the Construction Manager in connection with the use and occupancy of the Project Site, and the Building, as amended from time to time. The Contractor shall immediately notify the Construction Manager in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternatives through which the same results intended by such portions of the rules and regulations can be achieved. The Construction Manager may, in the Construction Manager's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations. The Contractor shall also comply with all insurance requirements, applicable to use, and occupancy of the Project Site and the Building.

N. Maintain the existing building in a safe and weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. When work is scheduled after hours clean and remove all temporary barriers and protection so that the building can be occupied the following day when normal building occupancy will occur.

O. Keep public areas such as hallways, stairs, elevator lobbies, and toilet rooms free from accumulation of waste material, rubbish or construction debris.

P. Smoking, drinking of alcoholic beverages or open fires will not be permitted on the project site.

Q. Utility Outages and Shutdown:

1. Limit disruptions, shut downs, switch overs, etc. of utility services to hours the building is unoccupied, Saturdays, Sunday and/or holidays.

2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers, fire alarm system, electrical, data, and heating system, without 7 days notice to Construction Manager and authorities having jurisdiction.

3. Prevent accidental disruption of utility services to other facilities.

1.12 AVAILABILITY OF EXISTING BUILDING

A. The existing building work areas will be available to the Contractor(s) as follows:

1. Award of Contract: thru June 27, 2026

a. 3:30 PM thru 10:30 PM Monday thru Friday if access into the facility is required.

b. June 30, 2026 thru August 24, 2026: 7:00 AM thru 3:30 PM Monday thru Friday (if later hours are needed, the contractor can request authorization from the Owner through the CM).

2. September 15, 2026 thru January 31, 2027 (Punch List / Closeout Duration)

a. 3:30 PM thru 10:30- PM Monday thru Friday only when programs and school occupancy are not disrupted and with the approval of the Owner's Representative.

3. Construction operations which create dust, noise or fumes, particularly welding operations shall be schedule after school hours, when approved by the Owner's Representative.

4. Any work that occurs past the punch list phase, due to long-lead times must be done between the hours of 3:30 PM thru 10:30 PM

B. Upon request by the Contractor, the building may be made available, at the discretion of the Construction Manager and at the sole cost to the Contractor, during such times as are allowed by local noise ordnance, in addition to the above listed hours. A written request for use during these off-regular hours must be made at least two (2) days before the use. Such off-hours may include Saturdays, and Holidays.

1. If the Contractor requests the use of the facility for off-hours to maintain the scheduled completion date, the Contractor shall pay all additional costs in connection with opening, providing security and project management expenses incurred with no costs to the Construction Manager. All expenses shall be deducted from the Contractors contract price. Comply with other portions of this Section.

2. The contractor shall make no claim for delay for the inability of the Owner to make the site available for off-hours work. Should the Owner make the site available during these hours at the contractor's request, the cost will be borne by the Contractor.

C. ALL CONTRACTORS SHALL BE REQUIRED TO PERFORM SCHEDULED WORK WITHIN THE EXISTING BUILDING ONLY DURING THE TIME PERIODS INDICATED AND SHALL INCLUDE

IN THE BID ALL COSTS FOR LABOR, MATERIAL, ETC. INCLUDING PREMIUM TIME TO PERFORM THE WORK, PER PHASE PER TIME PERIOD.

1.13 COMPLETION OF WORK AFTER SCHEDULED COMPLETION DATE

A. Contractor(s) shall perform work only within these limitations and all manpower, equipment, etc., shall be provided as required to complete the work as per schedule. Contractor's failure to complete work in accordance with the scheduled milestone date for completion is subject to assessment of liquidated damages as set forth in the General Conditions. Any work completed after the scheduled time for completion of the work shall be performed after 4:30 PM when the building is unoccupied and upon approval by the Construction Manager.

B. The Contractor shall prepare a progress schedule in detail listing items of work, sections of building and the time required for each for approval.

C. The Contractor shall provide necessary manpower, equipment, etc., as required to maintain schedule developed within the time limitations as described above.

D. School Calender is available on the Owner's web site. Calendar is subject to modifications for civil service holidays, changes in education programs, snow days, etc.

1.14 SEQUENCE OF WORK

A. Refer to Section 01 1010 - Milestone Schedule.

1.15 SPECIFICATION SECTIONS APPLICABLE TO ALL CONTRACTS

A. Unless otherwise noted, **ALL Provisions of Division 00 and 01 listed below apply to all contracts.** Specific items of work listed under individual contract descriptions constitute exceptions.

B. **DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENT**

00 0115 LIST OF DRAWING SHEETS

00 1113 INVITATION TO BID

00 2113 INSTRUCTIONS TO BIDDERS

00 2115 RFI FORM

00 4100 BID FORM - CONTRACT #1 GENERAL CONSTRUCTION CONTRACTOR

00 4110 BID FORM – CONTRACT #2 PLUMBING CONTRACTOR

00 4120 BID FORM – CONTRACT #3 MECHANICAL CONTRACTOR

00 4130 BID FORM – CONTRACT #4 ELECTRICAL CONTRACTOR

00 4140 BID FORM - CONTRACT #5 SITE CONTRACTOR

00 4301 BID FORM SUPPLEMENTS COVER SHEET: (Includes attachments 1-10 as follows):

1. Combined Insurance Coverage Certification
2. Form of Disclosure
3. Hold Harmless Agreement
4. Certification of Compliance with Iran Divestment Act
5. Declaration of Bidders Inability to Provide Certification of Compliance with Iran Divestment Act
6. Labor Law 220-I Certification Form
7. Non-Collusive Form
8. Owner – Contractor Agreement
9. Qualifications of Bidders
10. Sexual Harassment Prevention Certificate

00 5200 FORM OF AGREEMENT

00 6000 BONDS AND CERTIFICATES

00 7200 GENERAL CONDITIONS

C. **DIVISION 01 - GENERAL REQUIREMENTS**

01 1000 SUMMARY OF CONTRACT

01 1010 MILESTONE SCHEDULE

01 2000 PRICE AND PAYMENT PROCEDURES

01 2005 PARTIAL RELEASE OF LIEN

01 2100 ALLOWANCES

01 2500 SUBSTITUTION PROCEDURES

01 3000 ADMINISTRATIVE REQUIREMENTS

01 3216 CONSTRUCTION PROGRESS SCHEDULE

01 3306 NON DISCRIMINATION CLAUSES

01 3307 SED SPECIAL REQUIREMENTS

01 3553 SITE SAFETY AND SECURITY PROCEDURES

01 3554 PREVAILING WAGE RATES

01 4000 QUALITY REQUIREMENTS

01 4100 REGULATORY REQUIREMENTS

01 4219 REFERENCE STANDARDS

01 5000 TEMPORARY FACILITIES AND CONTROLS

01 5500 VEHICULAR ACCESS AND PARKING

01 6000 PRODUCT REQUIREMENTS

01 6100 COMMON PRODUCT REQUIREMENTS

01 6116 VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

01 7000 EXECUTION

01 7123 FIELD ENGINEERING

01 7310 CUTTING AND PATCHING

01 7600 PROCEDURES AND SPECIAL CONDITIONS FOR SEPARATE PRIME CONTRACTS

01 7419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

01 7800 CLOSEOUT SUBMITTALS

01 7900 DEMONSTRATION AND TRAINING

01 9113 GENERAL COMMISSIONING REQUIREMENTS

D. **APPENDIX**

FOOD SERVICE EQUIPMENT CUTSHEETS

1.16 CONTRACT #1 - GENERAL CONSTRUCTION

A. The work of the General Construction Contract #1 includes but not limited to the following:

1. DIVISION 02 - EXISTING CONDITIONS

   a. 02 6500 - UNDERGROUND STORAGE TANK REMOVAL

2. DIVISION 03 CONCRETE

   a. 03 3000 CAST IN P LACE CONCRETE

   b. 03 5400 CAST UNDERLAYMENT

3. DIVISION 04 MASONRY

   a. 04 0100 MAINTENANCE OF MASONRY

   b. 04 2000 UNIT MASONRY

4. DIVISION 05 - METALS

   a. 05 4000 COLD-FORMED METAL FRAMING

   b. 05 5000 METAL FABRICATIONS

5. DIVISION 06 – WOOD, PLASTIC AND COMPOSITES

   a. 06 1000 ROUGH CARPENTRY

   b. 06 1010 ROOF RELATED ROUGH CARPENTRY

6. DIVISION 07 - THERMAL AND MOISTURE PROTECTION

   a. 07 5010 MODIFICATIONS TO EXISTING ROOFING

   b. 07 5235 ELASTOMERIC MEMBRANE DUCT WATERPROOFING

   c. 07 5323 EPDM ROOFING

   d. 07 6200 SHEET METAL FLASHINGS & TRIM

   e. 07 7200 ROOF ACCESSORIES

   f. 07 8400 FIRESTOPPING

   g. 07 9200 JOINT SEALANTS

7. DIVISION 08 - OPENINGS

   a. 08 1113 HOLLOW METAL DOORS AND FRAMES

   b. 08 1613 FIBERGLASS DOORS AND ALUMINUM FRAMES

   c. 08 3100 ACCESS DOORS AND PANELS

   d. 08 7100 DOOR HARDWARE

   e. 08 8000 GLAZING

   f. 08 9100 LOUVERS

8. DIVISION 09 - FINISHES

   a. 09 2116 GYPSUM BOARD ASSEMBLIES

   b. 09 3000 TILING

   c. 09 5100 ACOUSTICAL CEILINGS

   d. 09 6500 RESILIENT FLOORING

   e. 09 9113 EXTERIOR PAINTING

f. 09 9123 INTERIOR PAINTING

9. DIVISION 10 - SPECIALTIES

a. 10 1100 VISUAL DISPLAY BOARDS

b. 10 1400 SIGNAGE

c. 10 2601 WALL AND CORNER GUARDS

10. DIVISION 11 - EQUIPMENT

a. 11 4000 FOOD SERVICE EQUIPMENT

11. DIVISION 12 - FURNISHINGS

B. **Special Notes: CONTRACT - #1 - GENERAL CONSTRUCTION**

1. Access doors furnished by trade requiring access; installation by General Contractor in new walls, floor, ceiling, etc., Access door required in existing walls, floors, ceilings, etc., shall be furnished and installed by the contractor requiring access.

2. All existing ceiling removal /replacements necessary to install General Contractor work will be by General Contractor including temporary support for all lighting fixtures, smoke detectors, etc.

3. General Contractor and subcontractors will not be allowed to use existing or new plumbing fixtures to wash out mortar pans, grout, adhesives, etc.

4. All new roof curbs are supplied by Mechanical Contractor and installed by General Contractor. Cutting penetrations, steel support, and temporary weather protection by General Contractor. Curbs will be flashed / watertight in accordance with roofing section. Hole patching (structural, EPDM, etc.) for roof areas which result from Mechanical demolition of existing rooftop units will be by Contract for General Contractor.

5. General Contractor will restore / patch any finishes damaged by their abatement subcontractor's protections, tape, etc.

6. General Contractor is responsible to provide negative air machines to ventilate all work areas during tasks involving odors, dust, fumes (epoxy floor, painting, etc.)

7. Exterior wall louvers for mechanical items shall be furnished and installed by General Contractor.

8. Within the existing building all cutting and removals of all interior slabs and excavation/ trenching shall be by the General Contractor. Utility trenching, bedding, warning tape and backfill to level indicated on drawings, shall be performed by the each trade Contractor. General Contractor shall provide final gravel base and concrete slab and finish as indicated on the drawings.

9. Protection of trenches is by General Contractor.

10. After removals of rooftop equipment General Contractor shall make existing roof watertight. Coordinate with all trades.

11. General Contractor is responsible for cutting, slotting and patching and finishing existing masonry walls for the Electrical Contractor.

12. The Owner shall have first refusal right for all kitchen appliances to be removed where items are chosen to be salvaged.

1.17 CONTRACT #2 - PLUMBING

A. **Work in the Plumbing Contractor Contract #2 includes, but is not limited to, the following:**

1. DIVISION 03 - CONCRETE

   a. 03 3000 CAST-IN-PLACE CONCRETE

2. DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

3. DIVISION 07 - THERMAL AND MOISTURE PROTECTION

   a. 07 8400 FIRESTOPPING

   b. 07 9200 JOINT SEALANTS

4. DIVISION 09 - FINISHES

   a. 09 5100 ACOUSTICAL CEILINGS

5. DIVISION 22 - PLUMBING

6. 22 1116 DOMESTIC WATER PIPING

7. 22 1316 SANITARY WASTE AND VENT PIPING

8. 22 1319 SANITARY WASTE PIPING SPECIALTIES

9. 23 1123 FACILITY NATURAL GAS PIPING

10. DIVISION 31 - EARTHWORK

    a. 31 2316 EXCAVATION

B. **Special Notes: CONTRACT - #2 for - PLUMBING CONTRACTOR**

1. Any wood blocking for Plumbing Contract, by Plumbing Contractor.

2. All existing ceiling removal / replacements necessary to install new Plumbing Contractor work will be by Plumbing Contractor unless otherwise noted.

3. Access doors furnished by trade requiring access; installation by General Contractor. in new walls, floor, ceiling, etc., Access door required in existing walls, floors, ceilings, etc., shall be furnished and installed by the Contractor requiring access.

4. Within the existing building all cutting and removals of all interior slabs and excavation/ trenching shall be by the General Contractor. Utility bedding, warning tape and backfill to level indicated on

drawings, shall be performed by the trade Contractor. General Contractor shall provide final gravel base and concrete slab and finish as indicated on the drawings.

5. Plumbing Contractor shall install an inflatable ball in all new plumbing fixtures to prevent construction debris or grout from entering sub-slab piping. Ball will be deflated / removed at the conclusion of the project as directed by the CM.

6. Plumbing Contractor will install sealant around perimeter of all toilet / plumbing fixtures.

7. Coordinate roof top removals with the General Contractor to maintain the building watertight.

8. Interior housekeeping pads for Plumbing Equipment shall be removed by the Plumbing Contractor.

9. Refer to food service equipment specifications section 11-4000 for coordination of work items.

1.18 CONTRACT #3 - MECHANICAL

A. **Work in the Mechanical Contract #3 includes, but is not limited to, the following:**

DIVISION 23 - MECHANICAL

1. 23 0500 BASIC MECHANICAL MATERIALS AND METHOD
2. 23 0519 METERS AND GAUGES FOR HVAC PIPING
3. 23 0523 GENERAL DUTY VALVES FOR HVAC PIPING
4. 23 0529 HANGERS AND SUPPORTS FOR HVAC PIPING
5. 23 0548 VIBRATION CONTROLS FOR HVAC PIPING
6. 23 0553 IDENTIFICATION FOR HVAC PIPING
7. 23 0593 TESTING, ADJUSTING AND BALANCING FOR HVAC
8. 23 0715 HVAC DUCT INSULATION
9. 23 0719 HVAC PIPING INSULATION
10. 23 0900 HVAC INSTRUMENTATION & CONTROLS
11. 23 0993 SEQUENCE OF OPERATIONS FOR HVAC EQUIPMENT
12. 23 2213 STEAM AND CONDENSATE HEATING PIPING
13. 23 2216 STEAM AND CONDENSATE HEATING PIPING SPECIALTIES
14. 23 3113 METAL DUCTS
15. 23 3300 DUCT ACCESSORIES
16. 23 3423 HVAC POWER VENTILATORS

17. 23 3713 DIFFUSERS, REGISTERS AND GRILLES

18. 23 7200 AIR TO AIR ENERGY RECOVERY EQUIPMENT

19. 23 7417 PACKAGED ROOFTOP AIR CONDITIONING UNITS

B. **Special Notes: CONTRACT #3 - MECHANICAL CONTRACTOR (HVAC)**

1. Any wood blocking for Mechanical Contract items by Mechanical Contractor.

2. All existing ceiling removal / replacements necessary to install new Mechanical Contract work will be by the Mechanical Contractor unless otherwise noted. Temporary supports for items to remain shall be by the Mechanical Contractor.

3. Interior housekeeping pads for Mechanical equipment by Mechanical Contractor.

4. Access doors furnished by trade requiring access; installation by General Contractor in new walls, floor, ceiling, etc., Access door required in existing walls, floors, ceilings, etc., shall be furnished and installed by the contractor requiring access.

5. Disconnects, Motor starters, etc. supplied by Mechanical Contractor shall be installed by Electrical Contractor, unless noted otherwise.

6. If new mechanical units are too large to fit through existing doorways the mechanical contractor will either disassemble equipment into sections, or remove masonry to enlarge opening and reconstruct to match (at no additional costs to Owner). Mechanical Contractor shall notify Construction Managerof proposed removals prior to removal. Architect and Construction Manager shall review for structural and other concerns. Removals shall not proceed without Architect and Construction Manager prior review and written approval. Mechanical Contractor shall be responsible for all additional costs incurred by the Architect review including structural analysis.

7. All new 24" high roof curbs and portals to be supplied by Mechanical Contractor (installed by General Construction Contractor).

8. Any interior exhaust grilles or wall louvers for mechanical items are by Mechanical Contractor including opening, lintels, caulking, etc.

9. Within the existing building all cutting and removals of all interior slabs and excavation/ trenching shall be by the General Contractor. Utility bedding, warning tape and backfill to level indicated on drawings, shall be performed by the trade Contractor. General Contractor shall provide final gravel base and concrete slab and finish as indicated on the drawings.

10. The Mechanical Contractor is responsible for cleaning/flushing/purging, capping of piping etc. for abandoned utility(s).

11. Coordinate roof top removals with the General Contractor to maintain the building watertight.

1.19 CONTRACT #4 - ELECTRICAL CONTRACTOR

A. **Work in the Electrical Contract #4 includes, but is not limited to, the following:**

1. DIVISION 03 - CONCRETE

a. 03 3000 CAST-IN-PLACE CONCRETE

2. DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

a. 06 1000 ROUGH CARPENTRY

3. DIVISION 07 - THERMAL AND MOISTURE PROTECTION

a. 07 8400 FIRESTOPPING

b. 07 9200 JOINT SEALANTS

4. DIVISION 09 - FINISHES

a. 09 5100 ACOUSTICAL CEILINGS

5. DIVISION 26 - ELECTRICAL

a. 26 0519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

b. 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

c. 26 0529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

d. 26 0533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

e. 26 0544 SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

f. 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS

g. 26 2416 PANELBOARDS

h. 26 2726 WIRING DEVICES

i. 26 2816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

DIVISION 28 – ELECTRONIC SAFETY and SECURITY

a. 28 4621 ADDRESSABLE FIRE-ALARM SYSTEMS

DIVISION 31 - EARTHWORK

a. 31 2316 EXCAVATION

B. **Special notes: - CONTRACT #4 ELECTRICAL**

1. VFD's, disconnects, motor starters which are supplied by Mechanical Contractor will be installed by Electrical Contractor unless noted otherwise.

2. All existing ceiling removal / replacement necessary to install new electrical work to be by the Electrical Contractor unless otherwise noted. Temporary supports for light fixtures, smoke detectors, etc. to remain shall be by the Electrical Contractor.

3. Access doors furnished by trade requiring access; installation by for General Contractor. in new walls, floor, ceiling, etc., Access door required in existing walls, floors, ceilings, etc., shall be furnished and installed by the Contractor requiring access.

4. Interior housekeeping pads for electrical equipment by Electrical Contractor.

5. Coordinate rooftop removals with General Contractor to maintain building watertight.

6. Within the existing building all cutting and removals of all interior slabs and excavation/ trenching shall be by the General Contractor. Utility bedding, warning tape and backfill to level indicated on drawings, shall be performed by the trade Contractor. General Contractor shall provide final gravel base and concrete slab and finish as indicated on the drawings. The Electrical Contractor is responsible for cleaning, flushing, purging, capping of piping etc. for abandoned utility(s).

7. If the electrical switchgear, panels are too large to fit through existing openings, Electrical Contractor will remove masonry to enlarge the opening and reconstruction to match (at no additional cost to Owner). Electrical Contractor shall notify Construction Manager proposed removals prior to removal. Architect and Construction Manager shall review for structural and other concerns. Removals shall not proceed without Architect and Construction Manager prior review and written approval. Electrical Contractor shall be responsible for all additional costs incurred by the Architect and Construction Manager review including structural analysis.

8. Any wood blocking or panel backboards for electrical items by Electrical Contractor.

9. Electric Contractor will tie up and secure with zip ties or J hooks, 5' oc, any existing cabling or wiring which sags below ceiling after any ceiling removals.

10. Temporary power as indicated on drawings or required. Refer to Section 01 5000 - Temporary Facilities and Controls

11. Any solenoid valves will be supplied and installed by Plumbing Contractor. Electrical power wiring supply and install by Electrical Contractor.

12. Electrical Contractor shall firestop electrical back boxes, where required, in fire rate partitions as per detail.

13. Coordinate roof top removals with the General Contractor to maintain the building watertight.

14. Refer to Food Service Equipment specification section 11-4000 for coordination of work items.

1.20 CONTRACT NO. 5 - SITE CONSTRUCTION

A. **Work in the Site Contract #5 includes, but is not limited to, the following:**

1. DIVISION 1 - GENERAL REQUIREMENTS

   a. 01 4516.13 CONTRACTOR QUALITY CONTROL

   b. 01 5713 TEMPORARY

   c. 01 5728 TEMPORARY SANITARY SEWER FLOW CONTROL

d. 01 7213 FIELD ENGINEERING

2. DIVISION 2 - EXISTING CONDITIONS

a. 02 6500 - UNDERGROUND STORAGE TANK REMOVAL

3. DIVISION 03 - CONCRETE

a. 03 3001 SITE CAST-IN-PLACE CONCRETE

4. DIVISION 23 - HVAC

a. 23 1010 UNDERGROUND FUEL TANK SYSTEM

b. 23 1113 FACILITY FUEL OIL PIPING

5. DIVISION 31 - EARTHWORK

a. 31 0513 SOILS FOR EARTHWORK

b. 31 0516 AGGREGATES FOR EARTHWORK

c. 31 0519.13 GEOTEXTILES FOR EARTHWORK

d. 31 1000 SITE CLEARING

e. 31 2213 SUB-GRADE PREPARATION

f. 31 2316 SITE EXCAVATION

g. 31 2316.13 TRENCHING

h. 31 2316.26 ROCK REMOVAL

i. 31 2319 DEWATERING

j. 31 2323 FILL

k. 31 2323.33 FLOWABLE FILL

l. 31 3700 RIPRAP

m. 31 4100 SHORING

6. DIVISION 32 - EXTERIOR IMPROVEMENTS

a. 32 1123 AGGREGATE BASE COURSESE FOR EXTERIOR

b. 32 1216 ASPHALT PAVING

c. 32 1313 CONCRETE PAVING

d. 32 1723 PAVEMENT MARKINGS

e. 32 1726 TACTILE WARNING SURFACES

f. 32 2802 WATER DISTRIBUTION

g. 32 3113 CHAIN LINK FENCE AND GATES

h. 32 9220 RESTORATION OF TURF AREAS

i. 32 9300 SEALANTS

7. DIVISION 33 - UTILITIES

a. 33 0130.13 SEWER AND MANHOLE TESTING

b. 33 0561 CONCRETE MANHOLES

c. 33 4213 PIPE CULVERTS

d. 33 4443 VORTEX TYPE HYDRODYNAMIC SEPARATORS

e. 33 4600 SUBDRAINAGE

f. 33 4601 STORMWATER MANAGEMENT AREAS

g. 33 4623 CMP UNDERGROUND DETENTION SYSTEM

B. Division 01 - General Requirements:

1. Specification sections listed above.

2. Section 01 7000: Basic project engineering and layout.

3. Section 01 5000: Utility services to point of delivery indicated, and installation of meters.

4. Section 01 5000: Payment of costs of temporary utilities and services consumed.

5. Section 01 5000: Provide debris receptacles, remove debris from site.

6. Section 01 5000: Erosion control structures.

7. Section 01 7000: Final cleaning.

C. The work of the Site Construction Contract includes but not limited to the following: (Refer to associated spec sections listed in the Table of Contents.)

1. Site improvements, including roadways, parking lots, pedestrian paving, site development, furnishings, equipment, landscaping, and athletic fields

2. Site preparation, including clearing

3. Scoping of Site

4. Removals

5. Undergorund oil tank removal.

6. New underground oil tank and oil piping

7. Excavation

8. Excavation for electrical contract, HVAC contract, plumbing contract, and electrical contract

9. Backfilling

10. Site water supply, distribution and fire hydrants.

11. Site sanitary sewer.

12. Site storm sewer.

13. Site utilities, including gas distribution systems, electrical distribution system, telephone, cable, data, and spare conduits.

14. Site irrigation systems.

15. Site Concrete.

16. Site Amenities

17. Irrigation Systems.

18. Pre cast structures.

19. Asphalt Supplier.

20. Selective demolition and removals.

SECTION 01 1010
MILESTONE SCHEDULE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Milestone Construction schedule for project durations and phases, for contract(s).

B. Related Sections include the following:

1. Section 01 1000 - Summary of Contracts for work related to each Prime Contract.

2. Section 01 3000 - Administrative Requirements for administrative requirements governing preparation and submittal of each Contractors' Construction Schedule.

3. Section 01 3216 - Construction Progress Schedule governing preparation of Prime Contractors' Construction Schedule.

4. Section 01 7800 - Closeout Submittals.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

B. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.

C. Predecessor activity is an activity that must be completed before a given activity can be started.

D. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration.

E. Event: The starting or ending point of an activity.

F. Major Area: A story of construction, a separate building, or a similar significant construction element.

G. Milestone: A key or critical point in time for reference or measurement.

1.4 REGULATORY REQUIREMENTS

A. Comply with Section 01 3553 - Site Safety and Security Procedures including ID badge, safety vest, hard hat, etc. and all other required personal protective equipment as required by OSHA.

1. Failure to abide by the aforementioned rules in paragraph (B) not limited to the Owner's requirements, and OSHA' safety rules and regulations, and without prior notice shall result in the removal of said individual from the site

1.5 MILESTONE SCHEDULE PREPARATION

A. A Master Schedule will be developed at a general meeting of all successful prime contractors within 10 days of Letter of Intent or Award of the Contracts. Each prime contractor will coordinate activities, forward submittals, deliver materials and provide necessary manpower to meet the milestones listed below.

1.6 REQUIREMENTS

A. By submitting his/her bid the contractor acknowledges and certify that the project will be completed by the Substantial Completion date and that his/her total base bid has been submitted in accordance with the specifications.

B. Each prime contractor and their subcontractor's project superintendent, employees, directly or indirectly employed by the contractor to work on the project must at all times, whenever on the school property, wear an ID badge, safety vest, hard hat, etc. and all other required personal protective equipment as required by OSHA.

PART 2 PRODUCTS

2.1 MILESTONE SCHEDULE

A. Building Hours: Refer to Section 01 1000 - Summary of Contracts.

B. The contractor shall have no claim for damages arising from the Owner's inability to make the site available for off-hours work.

C. Administrative Schedule

1.	Drawings out to Bid	Date 1/14/2026
2.	Pre-Bid Meeting	Date 1/28/2026
3.	Contractor's RFIs Due	Date 2/5/2026
4.	Bids Received	Date 2/11/2026
5.	Construction Schedule - General Construction	7 days after Contract Award/Letter of Intent
6.	Master Construction Schedule Final Intent	21 days after Contract Award /Letter of

2.2 MILESTONE SCHEDULE

A. All work required by the **Fuller and D'Angelo, P.C., Construction Manager, Consultant, and Attorneys** etc, to execute final close-out of the contract after 30 days beyond Milestone dates, if determined to be caused by Contractor, shall result in additional payment(s) to the Fuller and D'Angelo,

P.C., Construction Manager, Consultant, and Attorneys etc. in the form of a change order deduct to the base contract.

PART 3 EXECUTION (NOT APPLICABLE)

SECTION 01 2005
PARTIAL RELEASE OF LIEN

1.1 CONTRACTOR/SUBCONTRACTOR/VENDOR'S LETTERHEAD

A. Name of Facility: Seely Place ES & Greenville ES

B. Name of Owner: Edgemont Union Free School District

Project: Seely Place ES & Greenville ES Interior Renovations & Site Improvements

C. Name of the Contractor/Subcontractor/Vendor: _____

D. Address: _____

E. Trade/Vendor:_____

F. Application # _____ Dated _____.

G. We certify that we have completed _____% of our Contract.

H. Prior to this requisition we have received payment equal to _____ % of of our contract amount.

I. The undersigned, upon receipt of the above requisition payment hereby releases and discharges the Owner of and from any liability or obligation in any way related to or arising out of this project up to and including the date of this document.

J. The undersigned further covenants and agrees that it shall not in any way claim or file a mechanic's or other lien against the premises of the above designated project, or any part thereof, or against any fund applicable thereto for any of the work, labor, materials heretofore furnished by it in connection with the improvement of said premises.

K. The undersigned further warrants that, in order to induce the Owner to release this partial payment, they have paid all claims for labor, material, .insurance, taxes, equipment, etc., employed in the prosecution of the work above, to date of this requisition.

L. The undersigned hereby releases and agrees to hold the Owner harmless from any and all claims in connection with the furnishing of such labor and materials, etc., for the construction of the aforementioned project.

M. The undersigned further guarantees that all portions of the work furnished .and/or provided by them are in accordance with the contract and that the terms of the contract with respect to these guarantees will hold for the period specified in said contract.

N. IN WITNESS WHEREOF, we have executed under seal this release on the above date and to be legally bound hereby:

O. WITNESS: _____FIRM: _____

P. BY: _____

Q. _____

R. State of New York, County of _____ subscribed and sworn to before me this _____ day of _____ 202____

S. Notary public

T. My commission expires _____

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Contingency Allowances

B. Commissioning Allowance

1.3 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.4 CONTINGENCY ALLOWANCES

A. Contingency Allowances includes Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit and will be included in the Change Order(s) authorizing expenditure of funds from this Contingency Allowance.

B. Funds will be drawn from the Contingency Allowances only by Change Order.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

D. Contingency Allowances included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work and overhead and profit.

E. Contingency Allowances is an amount proposed by bidders, included on the Bid Form, as a cost per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if **additional work is required and not indicated or can be inferred by the Contract Documents** or requested to be added or deleted from the base bid. Contingency allowances listed on the Bid Form are to be included in the Total Bid Proposal.

F. Quantities indicated are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

G. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

1. Assist by providing necessary equipment, workers, and survey personnel as required.

H. Payment for Work governed by Contingency allowances will be made on the basis of the actual measurements and quantities of Work which is incorporated in or made necessary by the Work and accepted by the Fuller and D'Angelo, P.C. , multiplied by the unit sum/price.

I. Payment will not be made for any of the following:

1. **Work performed prior to measurement and establishing quantities approved by Owner or Architect.**

2. Products wasted or disposed of in a manner that is not acceptable.

3. Products determined as unacceptable before or after placement.

4. Products placed beyond the lines and levels of the required Work.

5. Loading, hauling, and disposing of rejected products.

1.5 ALLOWANCES SCHEDULE

A. **COMMISSIONING ALLOWANCE - MECHANICAL Contract # 3**

1. (HVAC -1) Costs Included in the Commissioning Allowances: Cost of an Commissioning Agent selected by the Owner to perform commissioning of the RTU, FANS and BMS as directed by the LFG Engineers.

a. TOTAL COMMISSIONING ALLOWANCE

b. EIGHT THOUSAND_____ ($ 8,000.00) DOLLARS

c. **(INSERT ON MECHANICAL BID FORM)**

B. **CONTINGENCY ALLOWANCES - SITE Contract #5**

1. SC- 1Removal of Trench Rock:

   a. Description: Removal of trench rock off site and backfill resultant void.

      Unit of Measurement: Cubic Yard

      Quantity: ten cubic yards of trench rock including backfilling.

   b. Ten cubic yards @_$_____ per each yard:

   c. _____ ($_____) DOLLARS

2. SC-2 Removal of Mass Rock:

   a. Description: Removal of mass rock, backfill resultant void and disposed off site.

      Unit of Measurement: Cubic Yard

      Quantity: Ten cubic yards of mass rock including backfilling.

   b. Ten cubic yards @_$_____ per each yard:

   c. _____ ($_____) DOLLARS

3. SC- 3 New Engineered Fill:

   a. Description: Provide new engineered fill.

      Unit of Measurement: Cubic Yard

      Quantity: One hundred cubic yards

   b. one hundred cubic yards @_$_____ per each yard:

      _____ ($_____) DOLLARS

4. SC- 4 Removal and replacement of asphalt roadway assembly:

   a. Description: Remove existing pavement and install new asphalt roadway pavement assembly.

      Unit of Measurement: square feet

      Quantity: five hundred square feet

   b. five hundred square feet @ $_____ per square foot:

   c. _____ ($_____) DOLLARS

5. SC - 5 Removal and replacement of asphalt sidewalk pavement assembly.

   a. Removal of existing pavement and install new asphalt sidewalk pavement assembly.

      Unit of Measure: Square feet

      Quantity: Five hundred square feet

6. Five hundred square feet @_____ per square foot :

7. _____ (_____) DOLLARS

8. SC-6 Removal and replacement of concrete sidewalk assembly

   a. Description: Remove existing concrete pavement and install new concrete sidewalk pavement assembly.

      Unit of Measure: Square Feet

      Quantity: Five hundred square feet @ _____ per square foot:

   _____($_____) DOLLARS

9. SC-7 Removal of existing curb and install new concrete curb assembly.

   a. Description: Removal of existing curb and install new concrete curb assembly.

      Unit of Measure: Linear foot

      Quantity: Seventy five lineal feet @ _____per lineal foot:

   _____
   _____($_____) DOLLARS

10. SC-8 contaminated Soil

    a. Description: Removal of contaminated soil off site.

    b. Unit of measurement: Tons

    c. Fifty tons @ _____ per ton.

    _____($_____)Dollars

11. SC-9 Contaminated Water

    a. Description: Removal of contaminated water off site.

    b. Unit of measurement: Gallons

c. 100 gallons @_____per gallon

_____($_____) Dollars

TOTAL CONTINGENCY ALLOWANCE - CONTRACT #5 (INSERT ON SC BID FORM)

_____ ($_____) DOLLARS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Procedural requirements for proposed substitutions. Please refer to Article 6 (X) of the Generalfor additional requirements concerning substitutions.

1.3 RELATED REQUIREMENTS

A. Section 00 2113 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 00 7200 - General Conditions: Requirements for the construction including but not limited to application for payment, and changes to Work.

C. Section 01 2100 - Allowances, for cash allowances affecting this section.

D. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.

E. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling and restrictions on timing of substitution requests.

F. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.4 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.

2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.

4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Edgemont Union Free School District.

5. Waives claims for additional costs or time extension that may subsequently become apparent.

6. Agrees to reimburse Architect for review or redesign services associated with re-approval by authorities.

7. Statement indicating why specified material or product cannot be provided.

8. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

9. Samples, where applicable or requested.

10. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

11. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

12. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

13. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

14. Cost information, including a proposal of change, if any, in the Contract Sum.

15. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

16. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

1. Contractor's Substitution Request documentation must include the following:

a. Project Information:

a) Official project name and number, and any additional required identifiers established in Contract Documents.

b. Substitution Request Information:

a) Discrete and consecutive Substitution Request number, and descriptive subject/title.

b) Indication of whether the substitution is for cause or convenience.

c) Issue date.

d) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).

e) Description of Substitution.

f) Reason why the specified item cannot be provided.

g) Differences between proposed substitution and specified item.

h) Description of how proposed substitution affects other parts of work.

c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:

a) Physical characteristics.

b) In-service performance.

c) Expected durability.

d) Visual effect.

e) Sustainable design features.

f) Warranties.

g) Other salient features and requirements.

h) Include, as appropriate or requested, the following types of documentation:

(a) Product Data:

(b) Samples: Provide full size actual sample of item proposed for substitution. Sample shall be provided, without exception, even if the originally specified item did not require a sample.

(c) Certificates, test, reports or similar qualification data.

(d) Drawings, when required to show impact on adjacent construction elements.

d. Impact of Substitution:

a) Savings to Edgemont Union Free School District for accepting substitution.

b) Change to Contract Time due to accepting substitution.

c) Changes to other aspects of the Work.

e. See Section 00 4301 - General Conditions, Article 6.X, for additional substitution requirements.

D. Limit each request to a single proposed substitution item.

1. Submit an electronic document, combining the request form with supporting data into single document.

2. Deliver sample to Architect.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Refer to Section 00 4301 - General Conditions, Article 6.X.

3.3 SUBSTITUTION PROCEDURES AFTER AWARD OF CONTRACT

A. Submittal Form:

1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

2. Submit substitution proposals with the bid package.

B. Substitutions will not be considered under one or more of the following circumstances:

1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

2. Without a separate written request.

3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

3.5 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

3.7 ATTACHMENTS

A. A facsimile of the Substitution Request Form (During Construction) required to be used on the Project is included after this section.

SUBSTITUTION REQUEST FORM

Provide form typewritten Hand written forms will not be accepted.

3.8 SUBSTITUTION REQUEST No. _____

A. (After the Bidding Phase)

B. Project: Seely Place ES & Greenville ES Interior Renovations & Site Improvements

C. Substitution Request Number: _____

D. From: _____

E. Date: _____

F. A/E Project Number: 24529.03

G. Contract For: _____

H. Specification Title: _____Description: _____

I. Section:_____ Page:_____ Article/Paragraph: _____

J. Proposed Substitution:

1. Manufacturer: _____ Address: _____ Phone:_____
2. _____model no.: _____
3. Installer:_____ Address: _____ Phone: _____
4. History: _____New product _____2-5 years old _____ 5-10 yrs old _____ More than 10 years old
5. Differences between proposed substitution and specified product:
   _____
6. Point-by-point comparative data attached - REQUIRED
7. Reason for not providing specified item: _____

K. Similar Installation:

1. Project: _____ Architect: _____
2. Address:_____ Owner: _____
3. Date Installed: _____

L. Proposed substitution affects other parts of Work: ____ No ____Yes; explain
_____

M. Savings to Owner for accepting substitution: _____ ($)

N. Proposed substitution changes Contract Time: ____ No ____ Yes Add _____Deduct _____days.

O. Supporting Data Attached: ____ Drawings ____ Product Data ____ Samples _____ Tests Reports

P. The Undersigned certifies:

1. Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.

2. Same warranty will be furnished for proposed substitution as for specified product.

3. Same maintenance service and source of replacement parts, as applicable, is available.

4. Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.

5. Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.

6. Proposed substitution does not affect dimensions and functional clearances.

7. Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

8. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Q. Submitted by: _____

R. Signed by: _____

S. Firm: _____

T. Address: _____

U. Telephone: _____

V. Attachments:

W. A/E's REVIEW AND ACTION

X. Refer to Specification Section 01 3000 - Administrative Requirements.

Y. :_____Date:_____

Z. Additional Comments: __ Contractor __ Subcontractor __ Supplier __ Manufacturer __ A/E

AA. _____

BB. _____

CC. _____

DD. _____

EE. _____

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Contractor's daily reports.

E. Proof of Orders & Delivery Dates.

F. Coordination and coordination drawings.

G. Submittals for review and information.

H. Number of copies of submittals.

I. Requests for Interpretation (RFI) procedures.

J. Submittal procedures.

K. Submittal Cover Sheet.

1.3 RELATED REQUIREMENTS

A. Section 00 2115 - RFI Form.

B. Section 00 7200 - General Conditions: Requirements for the construction including but not limited to applications for payment, and changes in the Work.

C. Section 01 1000 - Summary of Contracts: ,, occupancy .

D. Section 01 1010 - Milestone Schedule.

E. Section 01 2000 - Price and Payment Procedures

F. Section 01 2500 - Substitution Procedures.

G. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

H. Section 01 3553 - Site Safety and Security Procedures.

I. Section 01 5000 - Temporary Facilities and Controls.

J. Section 01 7000 - Execution.

K. Section 01 7800 - Closeout Submittals.

L. Section 01 9113 - General Commissioning Requirements: Additional procedures for submittals relating to commissioning.

1. Where submittals are indicated for review by Architect, Consultant, and Commissioning Authority submit one extra and route to Construction Manager first, before forwarding to the Construction Manager and Commissioning Authority.

1.4 REFERENCE STANDARDS

A. See Section 01 4219 - Reference Standards.

1.5 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - Execution for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Construction Manager:

1. Requests for Interpretation (RFI).
2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout Submittals.

1.6 PROJECT COORDINATION

A. Construction Manager

1. The District will not be furnishing construction coordination services through its own staff and has engaged a construction manager to provide all construction management/administration services.

2. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings. Prepare similar memoranda for the Architect and Construction Manager and separate Contractors where coordination of their work is required.

B. Each Contractor shall:

1. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

a. Preparation of schedules.

b. Installation and removal of temporary facilities.

c. Processing of submittals and photocopying/delivery to affected contractors.

d. Progress meetings.

e. Project closeout activities.

2. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3. Coordination: Each Contractor shall coordinate its construction operations with those of other Prime Contractors and subcontractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

a. Coordinate installation of different components with other Prime Contractors and/or subcontractors to ensure maximum accessibility for required maintenance, service, and repair

C. Each shall cooperate with the Construction Manager in allocation of mobilization areas of site, access, traffic, parking facilities, field offices, and sheds.

1. During construction, coordinate use of site and facilities through the Construction Manager.

D. Comply with Architect's and Construction Manager's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Construction Manager for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 5000 - Temporary Facilities and Controls.

F. Coordinate field engineering and layout work under instructions of the Construction Manager.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Construction Manager will schedule a meeting after Notice of Award.

B. Attendance Required:

1. Edgemont Union Free School District.

2. Fuller and D'Angelo, P.C.

3. Consultants.

4. Construction Manager

5. All contractors.
6. Contractor's Field Superintendent.

C. Agenda:

1. Execution of Edgemont Union Free School District-Contractor Agreement.
2. Submission of executed Bonds and Insurance certificates.
3. Distribution of Contract Documents.
4. Submission of schedule of values, progress schedule, list of products, and list of subcontractors/suppliers.
5. Submission of initial Submittal schedule.
6. Submission of DOL Award of Contract form (PW-39).
7. Designation of personnel representing the parties to Contract.
8. Procedures and processing of field decisions, submittals, substitutions, applications for payments, change orders, and contract closeout procedures.
9. Review construction scheduling.
10. Use of premises by Owner and Prime Contractors.
11. Edgemont Union Free School District's requirements and occupancy prior to completion.
12. Temporary utilities provided by Edgemont Union Free School District.
13. Survey existing facilities prior to staring construction.
14. Survey and site layout.
15. Security and housekeeping procedures.
16. Procedures for testing.
17. Procedures for maintaining record documents.
18. Requirements for start-up of equipment.

D. Construction Manager will record minutes and distribute copies within five days after meeting to participants, with copies to all participants, and those affected by decisions made.

3.2 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at minimum of two week intervals.

B. Construction Manager will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:

1. Edgemont Union Free School District.
2. Fuller and D'Angelo, P.C.
3. Construction Manager

4. Consultants.
5. All Contractors.
6. Contractor's Field Superintendent.
7. Major Subcontractors.
8. Suppliers as appropriate to agenda topics for each meeting.
9. Attendance is mandatory at each meeting and a penalty sum of $500.00 will be assessed to each Prime Contractor not attending without prior written authorization from the Construction Manager. Subcontractors, suppliers, or other entities will be invited at the discretion of the Construction Manager. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the work

D. Agenda:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of delivery schedules.
8. Review of off-site fabrication and delivery schedules.
9. Review construction safety programs.
10. Review exiting and separation of construction
11. Maintenance of progress schedule.
12. Corrective measures to regain projected schedules.
13. Planned progress during succeeding work period.
14. Coordination of projected progress.
15. Maintenance of quality and work standards.
16. Effect of proposed changes on progress schedule and coordination.
17. Other business relating to work.

E. Construction Manager will record minutes and distribute copies within 5 days after meeting to participants, with copies to all participants, and those affected by decisions made.

3.3 WEEKLY COORDINATION MEETINGS

A. The Construction Manager shall schedule and hold weekly general project coordination meetings at regularly scheduled times that are convenient for the attendance of all prime contractors and other parties involved. These meetings are in addition to specific meetings held for other purposes, such as regular project meetings and special pre-installation meetings. Required attendance includes all Prime Contractors and every other entity identified by any Prime Contractor as being currently involved the coordination or planning for the work of the entire project. Conduct meetings in a manner that resolve coordination problems. Contract #1 General Construction Contractor shall preside at each meeting, and shall record meeting results. Contract #1 General Construction Contractor shall distribute copies of the meeting result to everyone in attendance, the Architect and Construction Manager and to others affected by the decisions and actions resulting from each meeting.

1. Prime Contractors shall review with the Construction Manager the work schedule for the week in order to insure the planned work does not conflict with facility operations.

3.4 CONSTRUCTION PROGRESS SCHEDULE - See Section 01 3216

3.5 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Transmit reports electronically to Construction Manager at weekly intervals.

C. Each Prime Contractor shall prepare a daily construction report recording the following information concerning events at Project site and project progress:

1. Date.
2. High and low temperatures, and general weather conditions.
3. List of subcontractors at Project site.
4. Major equipment at Project site.
5. Material deliveries.
6. Safety, environmental, or industrial relations incidents.
7. Meetings and significant decisions.
8. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
9. Testing and/or inspections performed.
10. List of verbal instruction given by Construction Manager.
11. Signature of Contractor's authorized representative.
12. Contractor's total manpower and work classification and construction activities to the list of items to be included in the daily construction reports.

3.6 PROOF OF ORDERS AND DELIVERY DATES

A. Within two (2) weeks after the approval of shop drawings, samples, product data and the like, the Contractor(s) shall provide copies of purchase orders for all equipment and materials which are not readily available in local stock or requested by Construction Manager. The Contractor(s) shall submit written statements from suppliers confirming the orders and stating promised delivery dates. Dates shall be indicated and coordinated with the Construction Schedule.

3.7 COORDINATION DRAWINGS

A. General Coordination

1. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

2. Notify affected utility companies and comply with their requirements.

3. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

4. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

5. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

6. After Edgemont Union Free School District occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Edgemont Union Free School District's activities.

7. General: General Construction Contractor includes general coordination of the entire work of the project, including preparation of general coordination drawings, diagrams and schedules and control of site utilization from the beginning of construction activity through project closeout and warranty periods .

8. Coordination: Each Prime Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Prime Contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

9. Each Prime Contractor shall provide information required by other Prime Contractor for preparation of coordination drawings required by a Prime Contractor.

10. All roofing work must be performed by roofing sub-contractors approved by the roofing manufacturer and insure roofing warranty is maintained.

11. Review drawings prior to submission to Architect and Construction Manager .

    a. Indicate all mechanical equipment, ductwork, and major piping, including elevations and dimensions to all fixed building elements, such as beams; columns; slabs; ceilings,

including ceiling suspension; framing; floors; walls; doors, including door swings; and windows affected by the equipment, ductwork, and piping.

b. Indicate all existing and proposed lighting fixtures and smoke detectors.

c. Show location of all valves, dampers (fire, smoke, volume, and automatic), coils, humidifiers, smoke detectors, etc. requiring access for service and maintenance.

d. Show all registers, grilles, diffusers, radiators and convectors, and other terminal elements.

e. Locate all access doors.

f. Include large-scale details and sections as required to fully delineate the conditions in congested areas, leaving space for the work of the other trades.

g. Show plan layout of all equipment and anchorage and fasteners

B. Special Coordination and Sleeve Drawings:

1. Procedures for special coordination drawings shall be in accordance with paragraphs below:

a. Methods:

a) All Contractors shall furnish sufficient experienced drafting and engineering personnel to prepare coordination drawings in the approved format,

b) Drawing Format: Shall be in AutoCad or other electronic format agreed to by all Contractors.

c) Drawing Transfer: Shall be on CD or other electronic format agreed to by all Contractors.

b. Contract #1 General Construction shall and participate in coordination meetings scheduled and directed by the Construction Manager. The Contract #1 General Construction shall submit the coordination drawings of their trades within 20 days from the date of the Letter of Award. Each of the other Prime Contractors shall prepare their coordination drawings within ten days of receiving the coordination drawing "Set" from the previous contractor.

c. Coordination drawings shall be completed and submitted for distribution in time so as not to delay the construction. The coordination drawings may lack complete data in certain instances pending receipt of shop drawings, but sufficient space shall be allotted for the items affected.

d. Contract #1 General Construction shall initiate coordinating the installations for all other Prime Contractors by means of coordination and sleeve drawings, as specified herein.

a) The Construction Contractor shall prepare electronic drawings indicating their equipment and appurtenances for each floor and phase, at not less than 3/8" scale. The drawings shall show beams, columns, ceiling grid and heights, walls/partitions, casework, floor to floor dimensions, floors, windows, door swings etc. that relates to the construction.

b) The Contract #1 General Construction shall transfer the electronic drawings to Contract #3 Mechanical Contractor, with copy to Construction Manager.

e. The Contract #3 Mechanical Contractor shall overlay electronic drawings, at a scale of 3/8" = 1'-0" showing all mechanical equipment, ductwork, and major piping, including elevations and dimensions to all fixed building elements, such as beams; columns; slabs; ceilings, including ceiling suspension; framing; floors; walls; doors, including door swings; and windows affected by the equipment, ductwork, and piping. Show all registers, grilles, diffusers, radiators and convectors, and other terminal elements Show location of all valves, dampers (fire, smoke, volume, and automatic), coils, humidifiers, smoke detectors, etc. requiring access for service and maintenance. Locate all access doors. Include large-scale details and sections as required to fully delineate the conditions in congested areas, leaving space for the work of the other contractors. Show plan layout of all equipment bases, pads, and inertia blocks. Clearly label all work by Mechanical Contractor.

a) Contract #3 Mechanical Contractor shall deliver electronic drawings to Contract #2 Plumbing Contractor, with copy to Construction Manager.

f. The Contract #2 Plumbing Contractor shall overlay on the electronic drawings prepared by the Mechanical Contractor and show all water supply, drain, waste, vent, sprinkler main and branch piping, risers and sprinkler heads and other major lines. Indicate piping elevations and locations of fire hose cabinets, drinking fountains, etc. which encroach on duct shafts. Locate valves and other items requiring access for service and maintenance. Locate all access doors. Avoid interference with Mechanical work and with building construction. Use same scale as drawing being overlaid. Clearly label all work by Plumbing Contractor.

a) Contract #2 Plumbing Contractor shall deliver electronic drawings to Contract #4 Electrical Contractor with copy of transmittal to Construction Manager.

g. The Contract #4 Electrical Contractor shall overlay the electronic drawings, prepared by General Construction, Plumbing, and Mechanical Contractors, all main conduit and bus runs, cable trays, light fixtures, major equipment, and switch gear and panel boards. Show elevations and clearances. Show all items requiring access for service and maintenance. Locate all access doors. Avoid interference with work and with building construction. Use same scale as drawings being overlaid. Clearly label all work by Electrical Contractor.

a) Electrical Contractor shall transfer electronic drawings to Contract #1 Construction Contractor with copy of transmittal to Construction Manager.

h. The Construction Contractor shall review and verify all beams, columns, ceiling grid and heights, walls/partitions, casework, floor to floor dimensions, floors, windows, door swings etc. that relates to the construction.

i. Each Contractor shall attend coordination meetings and participate as directed by Construction Manager to resolve interference and conflicts. All such coordination work is included in the contract responsibility of each involved contractor. When mutually agreed, make minor changes in ductwork, piping, or conduit routing or equipment location required

to avoid space conflicts, but do not resize items or relocate exposed items without the Architect's approval. Do not make changes in wall or chase locations, ceiling heights, door swings or locations, window or other openings, or other items affecting the function or aesthetic effect of the building. If conflicts or interference cannot be satisfactorily resolved with such minor changes, notify the Construction Manager who shall obtain a decision from the Architect.

j. Each Contractor shall prepare coordination drawings without awaiting final product approval of terminal devices, outlets, fixtures, etc. Provide sufficient space for such items and re-coordinate as required when final product approval is obtained.

k. No preference or advantage shall be given to any contractor in considering solution of conflicts, or grant priority to any one contractor in the allocation of space. If the contractors are unable to reach an agreement on a matter on a matter of interference the matter shall be submitted to the Architect for his binding decision. Should any problems of coordination require architectural or structural changes of design, this change shall be submitted to the Architect for approval.

l. After the electronic drawings have been coordinated and all necessary changes have been made, these drawings shall then by signed off by each of the Contractors, indicating their awareness of and agreement with the indicated routings and layouts and their inter-relationship with the adjoining or contiguous work of all contracts Thereafter, no unauthorized deviations will be permitted and if made without the knowledge or agreement of the Construction Manager or other affected contractors, will be subject to removal and correction at no additional cost to the Owner.

m. After final coordination and sleeve drawings have been agreed upon each Contractor shall sign the final coordination drawings. The Construction Contractor shall provide and distribute electronic drawings to each of the Prime Contractors, the Architect and Construction Manager for reference and record purposes. Contractors desiring additional copies of such drawings, beyond the basic distribution indicated above shall arrange and pay for cost of same.

2. Each Contractor as a working reference shall retain the record copies of final coordination drawings. All shop drawings, prior to their submittal to the Architect shall be compared with the coordination drawings and developed accordingly by the contractor responsible. Any revisions to the coordination drawings, which may become necessary during the progress of the work shall be noted by each Contractors and shall be neatly and accurately recorded on the record copies. Each Contractor shall be responsible for the up-to-date maintenance of their own record copies of the coordination drawings and keep one copy available at the site. Each Prime Contractor and sub contractors in the development of their “as-built” drawings thereto, shall utilize the coordination drawings and any subsequent changes. The Mechanical Contractor may not use coordination drawings for the submittal of ductwork.

3. NO EXTRA COMPENSATION will be paid to any Contractor for relocating any duct, pipe, conduit, or other material installed without coordination among trades involved or among other affected contractors. Each Contractor who causes any additional work to other contractors by improperly coordinated work or work not installed in accordance with the signed coordination drawings shall reimburse the affected other contractors for the cost of the additional work.

4. All changes in the work on any contract, whether a change in price is given or not, shall be shown on the coordination drawings.

5. Coordination drawings shall not be used for “shop drawings” or "as-built" drawings except where approved by the Owner's Representative.

6. Upon completion of the project, the Construction Contractor shall turn over the original electronic drawings to the Construction Manager.

3.8 REQUESTS FOR INTERPRETATION (RFI)

A. Use RFI Section 00 2115 - RFI Form.

B. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

2. A resolution to an issue which has arisen due to field conditions and affects design intent.

C. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

D. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.

a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.

b. Do not forward requests which solely require internal coordination between subcontractors.

2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

E. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.

2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::

a. Approval of submittals (use procedures specified elsewhere in this section).

b. Approval of substitutions (see Section - 01 6000 - Product Requirements)

c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the General Conditions of the Contract).

d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.

4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.

a. The Edgemont Union Free School District reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by Owner, Architect, and Construction Manager, and any of its consultants, due to processing of such RFIs.

F. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

1. Official Project name and number, and any additional required identifiers established in Contract Documents.

2. Discrete and consecutive RFI number, and descriptive subject/title.

3. Issue date, and requested reply date.

4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).

5. Annotations: Field dimensions and/or description of conditions which have engendered the request.

6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

G. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

H. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

1. Indicate current status of every RFI. Update log promptly and on a regular basis.

2. Note dates of when each request is made, and when a response is received.

3. Highlight items requiring priority or expedited response.

4. Remove improper or frivolous RFIs.

I. Review Time: Owner, Architect, and Construction Manager will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response

period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

J. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Edgemont Union Free School District.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.

2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

4. Notify Fuller and D'Angelo, P.C. within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.9 SUBMITTAL SCHEDULE

A. Each Contractor shall submit to Construction Manager for review in tabular format the following:

1. Shop Drawing and Submittal Log no later than ten (10) days after Letter of Award.

2. Submit at the same time as the preliminary schedule.

3. Format schedule to allow tracking of status of submittals throughout duration of construction.

4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.

a. Identify long lead and critical items critical to maintain the construction schedule.

5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

6. No payments will be processed when a submittal is not submitted as scheduled or the project fall behind schedule until the Contractor submits a revised schedule approved by the Construction Manager.

3.10 SUBMITTALS FOR REVIEW

A. Submittal Cover Sheet: Attached at the end of this section.

B. All submittals are the product and the property of the Contractor. The Owner, Architect, Consultants, or Construction Manager shall not be responsible for the Contractor's construction means, methods or techniques: safety precautions or programs; Acts or omission or failure to carry out the work in accordance with the contract documents.

C. Coordinate transmittal of related items so processing will not be delayed due to requirement of coordination.

1. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

2. Unauthorized submittals will be considered non-responsive and returned or discarded by the Architect without action.

D. Submittal Cover Sheet and Stamp Sheet, attached to this section, shall be used for **each** submittal.

E. All critical and long lead shop drawing submittals shall be submitted no later than ten (10) days after Letter of Award of Contract. No further payments will be made to the contractor after ten (10) days until all critical and long lead are submitted.

1. If the submittal is rejected for being incomplete, the time period for review does not start until the complete submittal is turned in to the Owner or Construction Manager.

F. When the following are specified in individual sections, including but not limited to the following, submit them for review:

1. Product data.

2. Shop drawings.

3. Samples for selection.

4. Templates.

5. Contractor's engineering calculations.

6. Design mix formulas.

7. Coordination drawings for use on-site).

8. Standard wiring diagrams.

9. Warranties.

10. Additional items identified in individual sections.

11. Proof of Orders.

G. Submit to Construction Manager for review for the limited purpose of checking for conformance with information given and the design concept expressed in the reviewing documents.

1. Submittals for Mechanical, Plumbing, Electrical, Structural, or others requiring consultant review submit directly to consultant with copy to Architect.

H. Samples will be reviewed only for aesthetics, color, or finish selection and for record documents purposes described in Section 01 7800 - Closeout Submittals.

I. After review, provide copies and distribute in accordance with Submittal Procedures article below .

J. The Architect, Consultant, and Construction Manager shall review and approve or take other appropriate action on the Contractor submittals, such as shop drawings, product data, samples and other data, which the Contractor is required to submit, but **only for the limited purpose of reviewing for conformance with the design concept and the information given in the Construction Documents**. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The Architect, Consultant, and Construction Manager's review shall be conducted with reasonable promptness while allowing sufficient time in the Architect's judgment to permit adequate review. Review of a specific item shall not indicate that the Architect, Consultant, and Construction Manager has reviewed the entire assembly of which the item is a component. **The Architect, Consultant, and Construction Manager shall not be responsible for any deviations from the Construction Documents not brought to the attention of the Architect, Consultant, and Construction Manager, in writing, by the Contractor.** The Architect and Consultant shall not be required to review partial submissions or those for which submissions of correlated items have not been received by Architect and Consultant.

K. Markings or comments on the shop drawing shall not be construed as relieving the Contractor from compliance with the contract project plans and specifications nor departure therefrom. The Contractor remains responsible for details of accuracy for conforming and correlating all quantities, verifying all dimensions for selecting fabrication processes, for techniques of assembly and for performing his work satisfactorily and in a safe manner.

L. **Architect, Consultant, and Construction Manager will review the original submittal and one (1) re submittal. Additional reviews due to the Contractor's failure to meet contract requirements will be additional services provided to the Owner and charged accordingly. All additional costs incurred by the Owner will back charge to the Contractor accordingly.**

M. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing and acquisition of materials to meet approved construction schedule.

N. Deviations: Highlight, encircle, or otherwise identify all deviations from the Contract Documents on submittals.

3.11 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information purposes only. The Construction Manager shall not review nor be responsible for the verification or any information contained herein.

1. Certificates.
2. Test reports.
3. Inspection reports.

4. Manufacturer's instructions.

5. Manufacturer's field reports.

B. Submit for Architect and Construction Manager's knowledge as contract administrator. No action will be taken.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Refer to Section 01 7800 - Closeout Submittals.

3.13 NUMBER OF COPIES OF SUBMITTALS AND FORMAT

A. Documents: Submit one electronic copy in PDF format; an electronically-marked up document will be returned. Create PDFs at native size and right-side up; illegible document will be rejected. Submittals shall conform to the following:

1. Each item shall be in a separate PDF format.

2. Each document name shall start with the specification section number and contain an abbreviated explanation of what it contains; for example:

a. 08 5113 Aluminum Window Shop Drawings; 08 8000 Glazing.

3. Add Revision number (Rev2 Rev3, etc) to the file name when resubmitting items, for example:

a. 07 5323 EPDM Revl.pdf Bond AdhRevl.pdf

4. Make all technical submittals at one time per trade- refer to the specification for additional submittal requirements for example:

a. Concrete; Masonry; Miscellaneous Fabrications; Roofing; etc.

5. Do not send MSDS with the technical submittals; collate all of the MSDS needed for the entire project in three ring binders, organized by specification section, and submit the binders to the Construction Manager, with copy of Transmittal to the Architect, and maintain one copy at the project site.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Construction Manager.

1. **Submit with each sample, in electronic PDF format, data, cuts, photos, color, charts, etc**.

2. Approved sample will be retained at the project site.

3. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES

A. General Requirements:

1. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.

2. **Transmit using Submittal Coversheet attached to this section.**

3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.

4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

5. Apply Contractor's stamp on the attached form, certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

    a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.

    b. **All submitted shop drawings shall be stamped and signed by the Contractor with the following note:**

        a) **We the undersigned certify that we have reviewed and coordinated this shop drawings with job conditions and Contract requirements and they are in conformance to the plans, specifications and other provisions of the Contract Documents.**

6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.

    a. Send submittals in electronic format via email to Construction Manager.

7. Schedule submittals to expedite the Project, and coordinate submission of related items.

    a. For each submittal for review, allow 10 working days excluding delivery time to and from the Contractor.

    b. For sequential reviews involving Architect and Consultant or another affected party, allow an additional 7 working days.

8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.

9. When revised for resubmission, identify all changes made since previous submission.

10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

12. **Submittals** not requested will be recognized and will be returned "Not Reviewed".

B. Product Data Procedures:

1. Submit only information required by individual specification sections.

2. Collect required information into a single submittal.

3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.

2. Do not reproduce Contract Documents to create shop drawings.

3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:

1. Transmit related items together as single package.

2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.15 SUBMITTAL REVIEW

A. Submittals for Review: Architect, Consultant, and Construction Manager will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Construction Manager will acknowledge receipt and review. See below for actions to be taken.

C. Contractor's Delegated Design:

1. Architect’s review and approval of delegated design submittals is limited to performance and design criteria and review of general design concepts in accordance with the General Conditions and Specifications.

D. Substitution:

1. The Contractor shall carry out the Work in accordance with the Contract Plans and Specifications without change in Contract Sum or Contract Time.

a. Proceeding with the Work, the Contractor acknowledges that they are responsible for:

a) coordinating this substitution with subcontractor(s) or other Prime Contractor(s)

b) The contractor is responsible and any additional work required by the substitution and any additional costs from subcontractors or other Prime Contractor(s) resulting from this substitution.

E. Architect, Consultant, and Construction Manager's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

1. Architect and Construction Manager's and their consultants' actions on items submitted for review:

a. **Authorizing purchasing, fabrication, delivery, and installation:**

   a) "No Exceptions Taken", or language with same legal meaning.

   b) "Make Corrections Noted", or language with same legal meaning.

b. **Sample:**

   a) Samples will be reviewed only for aesthetic, color, or finish.

c. **Not Authorizing fabrication, delivery, and installation:**

   a) "Revise and Resubmit"

      (a) Resubmit revised item, with review notations acknowledged and incorporated.

   b) "Rejected".

      (a) Submit item complying with requirements of Contract Documents.

d. Architect and Construction Manager**'s and their Consultants' actions on items submitted for information:**

   a) Items for which no action was taken:

      (a) "Received" - to notify the Contractor that the submittal has been received for record only.

   b) Items for which action was taken:

      (a) "Examined and Reviewed" - no further action is required from Contractor.

SUBMITTAL COVERSHEET

Edgemont Union Free School District

Seely Place ES & Greenville ES Interior Renovations & Site Improvements

ARCHITECT:	**OWNER:**
Fuller and D'Angelo, P.C.	**Edgemont Union Free School District**
45 Knollwood Rd.	**300 White Oak Lane.**
Elmsford, NY10523	**Scarsdale, NY 10583**

CONTRACTOR: _____ CONTRACT: _____

ADDRESS: _____

DATE _____TELEPHONE: _____EMAIL: _____

Facility Name: Seely Place ES & Greenville ES

Type of Submittal: Re-submittal: [ ] No [ ] Yes [ ] Certificate [ ] Warranty [ ] Color Sample

[ ] Shop Drawings [ ] Product Data[ ] Schedule [ ] Sample [ ] Test Report [ ] Certificate

SUBMITTAL DESCRIPTION: _____

PRODUCT NAME: _____

MANUFACTURER: _____

SUBCONTRACTOR/_____

SUPPLIER: _____

SPEC.#_____ DWG. #s _____ PAR.#: _____ RM. OR DETAIL #s: _____

STAMP SHEET

Contractor's Remarks And Stamp:

We the undersigned certify that we have reviewed and coordinated this shop drawings with job conditions and Contract requirements and they are in conformance to the plans, specifications and other provisions of the Contract Documents.

_____
_____
_____

A. **Architect's Comments and Stamp**

_____
_____
_____

NAME: _____ DATE: _____

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

C. Master Schedule.

1.3 RELATED SECTIONS

A. Section 01 1000 - Summary of Contracts: Work sequence and occupancy.

B. Section 01 3000 - Administrative Requirements.

1.4 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.5 RESPONSIBILITY

A. Each Contractor shall complete the detailed schedule within 10 days after Letter of Award.

B. Each Contractor shall develop a full schedule, in sufficient detail and clarity of form and technique so that the General Construction Contractor can plan and control his work properly and the Construction Manager can readily monitor and follow the progress for all portions of the work.

C. Contract #1 General Construction Contractor shall prepare a draft master schedule within 5 days after receiving schedules from each prime contractor and distribute to all prime contactors, Architect and Construction Manager.

1. Within 5 days after receiving draft master schedule all prime contractors shall meet to revise, (if required) and sign off on the master schedule.

    a. In the event of conflicts the Construction Manager shall resolve and provide direction which is in the best interest on the District.

2. Contract #1 General Construction Contractor shall be responsible for incorporating all final revision, schedules, of all prime contractors, and prepare a **full final master schedule,** and updates, as required or directed by the Construction Manager.

3. Identify all long lead items and dates required on site.

4. In the event of conflict Construction Manager shall resolve and provide direction which is in the best interest on the District.

5. Each Contractor shall coordinate their work with work of all prime contractors.

D. Contract #1 General Construction Contractor shall coordinate their work with work of all prime contracts.

E. The activities identified in the schedule shall be analyzed in detail to determine activity time durations in units of whole working days. All duration's shall be the result of definitive manpower and resource planning by each Contractor.

F. The activity data shall include activity codes to facilitate selection, sorting and preparation of summary reports and graphics. Activity codes shall be developed for:

1. Area: Subdivision of the building(s) and/or site(s) into logical modules or blocks and levels. Pods A, B, C and D, etc.

2. Contractor or subcontractor responsible for the work.

3. Specifications as listed in the Project Manual.

4. System: Division of the work into building systems for summary purposes.

5. Milestone: Work associated with completion of interim completion dates or milestones

1.6 SUBMITTALS

A. Submit updated master schedule with each Application for Payment.

B. Submit in PDF format.

C. When requested by the Construction Manager submit revised schedule when project fall behind schedule illustrating requirements to return the project on schedule.

D. Submit the number of opaque reproductions each prime contractor requires, plus two copies which will be retained by Architect and Construction Manager.

E. Submit under transmittal letter form specified in Section 01 3000 - Administrative Requirements.

F. All Contractors are hereby notified that payment requisitions will not be processed by the Architect and Construction Manager, nor paid by the Owner, until all schedules are reviewed, updated and approved by Owner's Representative and Master Schedule revised.

1.7 QUALITY ASSURANCE

A. Scheduler: Contractor 's personnel or specialist Consultant specializing in construction scheduling with three (3) years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.8 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each building and each activity. Identify each activity with the applicable specification section number.

B. Submit schedule in electronic PDF format.

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

B. Based on the preliminary development of the progress schedule and on feedback from Architect, Construction Manager, and other prime contractors or whatever updating may have occurred during the project start-up, Contract #1 General Construction Contractor shall, for the entire work of all the prime contracts, , prepare the (Master Schedule), secure critical time commitments for performing major elements of all the work.

3.2 GENERAL CONTENT.

A. Milestones: Include milestones in schedule, including, but not limited to, Notice of Award, Submittals, Verification of existing conditions, Asbestos/Lead Abatement, Removals, Delivery of Major Equiment, such as mechcanical Units, Fans, Motors, Installation, Substantial Completion, Completion of Punch List, Final Completion, and Closeout

B. Show complete sequence of construction by phase, activity, by room with dates for beginning and completion of each element of construction.

C. Identify each item by specification section number.

D. Identify work of Addition and other logically grouped activities.

E. Provide sub-schedules for each stage of Work identified in Section 01 1000 - Summary of Contracts.

F. Include conferences and meetings in schedule.

G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

H. Provide separate schedule of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Architect and Construction Manager. Indicate decision dates for selection of finishes.

I. Provide legend for symbols and abbreviations used.

3.3 BAR CHARTS

A. Include a separate bar schedule for Master Schedule each major portion of Work or operation.

B. Identify the first work day of each week.

3.4 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Construction Manager at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, the Master Schedule and resubmit within 5 days.

1. When project work is behind schedule indicate revisions required to put the project on schedule.

2. Payments will not be approved until satisfactory evidence is presented, by the Contractor(s) behind schedule, to put the project on schedule.

3.5 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Update diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.6 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Architect, Construction Manager, other Prime Contractors, subcontractors, and major suppliers and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

3.7 CHANGES, DELAYS AND EXTENSIONS OF TIME

A. When changes or delays are experienced, each Contractor shall submit to the Construction Manager a Time Impact Analysis illustrating the influence of each change or delay on the current Contract scheduled completion date. Each time analysis shall include a Fragment (network analysis) demonstrating how the Contractor proposed to incorporate the change or delay into the Detailed Schedule. Please refer to Article 13 of the General Conditions regarding time for completion of the work.

1. Each time analysis shall include a Fragment (network analysis) demonstrating how the Contractor proposed to incorporate the change or delay into the Detailed Schedule.

2. The analysis shall demonstrate the time impact based on the date the change was given to the Contractor, the status of construction at that point in time, and the activity duration of all effected activities.

3. The activity duration used in this analysis shall be those included in the latest update of the Detailed Schedule, closest to the time of delay or as adjusted by mutual agreement.

B. Each Time Impact Analysis shall be submitted within five (5) calendar days after a delay occurs or a notice of change order is given to the Contractor. In cases where the Contractor does not submit a Time Impact Analysis for a specific change or delay with a specified period of time, it shall be mutually agreed that no time extension is required. Final evaluation of each Time Impact Analysis by the Construction Manager shall be made within five calendar days after receipt unless subsequent meetings and negotiations are necessary. Adjustments in the Contract time for performance shall be made only by written change order approved by the Construction Manager. Upon approval of the Owner and Construction Manager, fragments illustrating the influence of changes and delays shall be incorporated into the Detailed Master Schedule by the Contract #1 General Construction during the first update after agreement is reached.

SECTION 01 3306
NON-DISCRIMINATION CLAUSES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REQUIREMENTS

A. During the performance of this contract, the Contractor agrees as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color or national origin, and will take affirmative action to insure that they are afforded equal employment opportunities without discrimination because of race, creed, color or national origin. Such action shall be taken with reference, but not be limited, to: recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff or termination, rates of pay or other forms of compensation, and selection for training or retraining, including apprenticeship and on-the job training.

2. The Contractor will send to each labor union or representative of workers with which he has or is bound by a collective bargaining or other agreement or understanding, a notice, to be provided by the State Commission for Human Rights, advising such labor union or representative of the Contractor's agreement under these clauses hereinafter called "non-discrimination clauses" and requesting such labor union or representative to agree in writing, standing or otherwise, that such labor union or representative will not discriminate against any member or applicant for membership because of race, creed, color or natural origin. Such action shall be taken with reference, but not limited, to: recruitment, employment job assignment, promotion, upgrading, demotion, transfer, layoff, or termination, rates of pay or other forms of compensation, and selection for training or retraining, including apprenticeship and on-the-job training. Such notice shall be given by the Contractor, and such written agreement shall be made by such labor union or representative, prior to the commencement of performance of this contract. If such labor union or representative fails or refuses so to agree in writing the Contractor shall promptly notify the State Commission of Human Rights of such failure or refusal.

3. The Contractor will post and keep posted in conspicuous places, available to employees and applicants for employment, notices to be provided by the State Commission for Human Rights setting forth the substance of the provisions of clauses and such provisions of the State's laws against discrimination as the State Commission for Human Rights shall determine.

4. The Contractor will state, in all solicitation or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color or national origin.

5. The Contractor will comply with the provisions of Section 291-299 of the Executive Law and the Civil Rights Law, will furnish all information and reports deemed necessary by the State Commission for Human Rights under these non-discrimination clauses and such sections of the Executive Law, and will permit access to his books, records and accounts by the State

Commission for Human Rights, the Attorney General and the Industrial Commissioner for purposes of investigation to ascertain compliance with these non-discrimination clauses and such sections of the Executive Law and Civil Rights Law.

6. This contract may be forthwith canceled, terminated or suspended, in whole or in part by the Owner upon the basis of a finding made by the State Commission for Human Rights that the Contractor has not complied with these nondiscrimination clauses, and the Contractor may be declared ineligible for future contracts made by or on behalf of the Owner or agency of the Owner, until he or it satisfies the State Commission for Human Rights that he or it has established and is carrying out a program in conformity with the provisions of these non-discrimination clauses. Such findings shall be made by the State Commission for Human Rights after conciliation efforts by the Commission have failed to achieve compliance with these nondiscrimination clauses and after a verified complaint has been filed with the Commission, notice thereof has been given to the Contractor and an opportunity has been afforded him to be heard publicly before three members of the Commission. Such sanctions may be imposed and remedies invoked independently of or in addition to sanctions or remedies otherwise provided by law.

7. If this Contract is canceled or terminated under the above clause, in addition to other rights of the Owner, provided in this contract upon its breach by the Contractor, the Contractor will hold the Owner harmless against any additional expenses or costs incurred by the Owner in completing the work or in purchasing the services, materials, equipment or supplies contemplated by this contract, and the Owner may withhold payments from the Contractors in an amount sufficient for this purpose and recourse may be had against the surety on the performance bond if necessary.

8. The Contractor will include the provisions of these clauses in every sub-contract or purchase order in such a manner that such provisions will be binding upon each sub-contractor or vendor as to operations to be performed within the State of New York. The Contractor will take such action in enforcing such provisions of such Sub-Contract or purchase order as the contracting agency may direct, including sanctions or remedies for non-compliance. If the Contractor becomes involved in or is threatened with litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor shall promptly so notify the Attorney General, requesting him to intervene and protect the interests of the Owner.

SECTION 01 3307
SED SPECIAL REQUIREMENTS`

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies special requirements of State Education Department, including Commissioner's Regulation Part 155.5, 155.7

1. Copies of Commissioner's Regulation Part 155.5, 155.7 are available on the State Education Department's web site.www.p12nysed.gov.

2. Copy of Commissioner's Regulation Part 155.5 is included as Appendix to the specifications.

3. Please refer to Article 4 of the General Conditions concerning Contractor's Use of the Site.

1.3 CERTIFICATE OF OCCUPANCY

A. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a Certificate of Occupancy.

1.4 GENERAL SAFETY AND SECURITY DURING CONSTRUCTION

A. All construction materials shall be stored in a safe and secure manner.

1. Fences around construction supplies or debris shall be maintained.

2. Gates shall always be locked unless a worker is in attendance, to prevent unauthorized entry.

3. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.

4. Workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites.

5. No drinking of alcholic beverages, smoking, or use of cannabis, cannabinoid hemp, personal vaporizing devices, or controlled substances is permitted in the buildings or on the grounds.

1.5 SEPARATION OF CONSTRUCTION

A. Separation of construction areas from occupied spaces. Construction areas that are under the control of a contractor and therefore not occupied by district staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Metal stud and gypsum board (Type X) must be used in exit ways or other areas

that require fire rated separation. Heavy duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier, and shall not be used to separate occupied spaces from construction areas.

1. A specific stairwell and/or elevator may be assigned for construction worker use during work hours, when approved by the Construction Manager. Workers may not use corridors, stairs or elevators designated for students or school staff.

    a. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.

    b. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each work day. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.

1.6 FIRE PREVENTION

A. There is no smoking on school property for fire prevention and New York State Law.

B. Any holes in floors or walls shall be sealed with a fire resistant material.

C. The Owner shall maintain existing fire extinguishers.

D. Fire alarm and smoke detection systems shall remain in operation at all times.

1.7 CONSTRUCTION DIRECTIVES

A. Construction Noise. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken.

1. Construction Fume Control: Each Contractor shall be responsible for the control of chemical fumes, gases, and other contaminates produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure they do not enter occupied portions of the building or air intakes.

2. Off-Gassing Control. Each Contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc., are scheduled, cured or ventilated in accordance with manufacturer's recommendations before a space can be occupied.

1.8 ASBESTOS

A. Asbestos/Lead Test Asbestos Letter. Indication that all school areas to be disturbed during renovation or demolition have been or will be tested for lead and asbestos.

B. Asbestos Code Rule 56. Large and small asbestos abatement projects as defined by 8 NYCRR 155.5(k) shall not be performed while the building is occupied. Note: It is SED's interpretation that the term "building" as referenced in this section, means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non combustible construction. The isolated portions (the occupied portion and the portion under construction) of the building must contain separate

code compliant exits. The ventilation systems must be physically separated and sealed at the isolation barrier(s).

1. Asbestos TEM. The asbestos abatement area shall be completely sealed off from the rest of the building and completely cleaned and tested by TEM prior to re-entry by the public.

2. Lead Abatement Projects. A project that contains materials identified to be disturbed which tests positive for lead shall include that information in the Construction Documents. The Construction Documents must address the availability of lead testing data for the building and include a statement that the OSHA regulations be followed and that cleanup and testing be done by HUD protocol.

1.9 VENTILATION

A. The work, as scheduled in the existing building, is to be performed when the facility is unoccupied. In the event that work is required to be performed during times when the building is occupied, all existing ventilation system between areas of work and areas of occupancy shall be disconnected, separated and code complying ventilation requirements be provided the occupied area. Prior to such work commencing each Contractor shall submit a plan, for review indicating procedure to be taken. Also see paragraph 1.5 above for additional requirements."

1.10 ELECTRICAL CERTIFICATION:

A. The Electrical Contractor shall obtain UL Certification or Inspection from a Certified Electrical Organization for electrical installation.

1.11 EXITING

A. Exiting: Work will be performed when school is not in session or after school hours. All exits will be clear and usable at all times.

B. All modifications or changes to the exiting plan shall be approved by the Construction Manager.

1.12 CONSTRUCTION WORKERS IN OCCUPIED AREAS

A. No worker shall be permitted in areas occupied by students. If access is required by the contractor's personnel they will be supervised by District personnel. Contractor shall provide 24 hour notice to the Owner when such access will be required.

B. The contractor, its employees, subcontractor's employees, or others engaged by the contractor for the performance of the work of the contract shall not communicate with students or staff.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

SECTION 01 3553
SITE SAFETY AND SECURITY PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

B. Please refer to Article 7 of the General Conditions.

1.2 SECTION INCLUDES

A. Refer to Section 01 4100 - Regulatory Requirements for additional requirements.

B. The safety requirements, which must be followed by each Contractor during the execution of this contract.

C. Security measures including entry control, personnel identification, and miscellaneous restrictions.

1.3 REFERENCES:

A. Code of Federal Regulations OSHA Safety and Health.

B. Education Department Regulations of the Commissioner Section 155.5 Uniform Safety Standards for School Construction and Maintenance Projects.

1.4 RELATED REQUIREMENTS

A. Section 01 1000 - Summary of Contracts: Use of premises and occupancy.

B. Section 01 3307 - SED Spectial Requirements.

C. Section 01 5000 - Temporary Facilities and Controls: Temporary lighting, site fence, and barriers and enclosures.

D. Section 01 5500 - Vehicular Access and Parking.

1.5 DEFINITIONS

A. Public shall mean anyone not involved with or employed by each Contractor to perform the duties of this contract.

B. Site shall mean the limits of the work area.

C. Contractor shall mean the Contractor, his/her subcontractors and any other person related to the contract execution.

1.6 SECURITY PROGRAM

A. Security and Protection Facilities and Services shall be the responsibility of each Contractor and all costs shall be included in their bid.

B. Initiate program in coordination with Edgemont Union Free School District's existing security system at project mobilization.

C. Maintain program throughout construction period until directed by Construction Manager .

1.7 ENTRY CONTROL

A. The existing building contains a security alarm system maintained and operated by the Owner. Access into the existing building shall not be permitted unless the Construction Manager is notified and arrangements made to deactivate the system

B. Each Contractor shall restrict entrance of persons and vehicles into Project site and existing facilities.

C. Allow entrance only to authorized persons with proper identification.

D. Maintain log of workers and visitors, make available to Edgemont Union Free School District on request.

E. Edgemont Union Free School District will control entrance of persons and vehicles related to Edgemont Union Free School District's operations.

F. Coordinate access of Edgemont Union Free School District's personnel to site in coordination with Construction Manager and Edgemont School District's security forces.

G. Traffic Control

1. Each Contractor shall maintain access for emergency vehicles, fireman and pedestrians and protect from damage all persons and property within the limits of and for the duration of the contract; all in accordance with the plans and specifications.

2. Conduct construction operations so that the traveling public and pedestrian safety is subjected to a minimum of hazard and delay.

3. Each Contractor shall perform the following minimum requirements as directed by Construction Manager.

   a. Keep the surface of the traveled way free from mounds, depressions, and obstructions of any type which could present hazards or annoyance to traffic.

   b. Keep the surface of all pavements used by the public free and clean of all dirt and debris or other obstructions to provide safe traveled ways.

   c. Control dust and keep the traveled way free from materials spilled from hauling and construction equipment.

   d. Provide all cones, barricades, signs and warning devices as may be required and/or as ordered by Construction Manager to safely carry out the foregoing. All such signs and devices shall be fabricated and placed in accordance with the latest “Federal Manual on Uniform Control Devices”. Use of Open Flares Is Prohibited.

4. Ingress and Egress

a. Each Contractor shall provide and maintain at all times safe and adequate ingress and egress to and from site at existing or at new access points consistent with work, unless otherwise authorized by the Construction Manager

5. All traffic control costs shall include, in the base bid, the furnishing all labor, material and equipment including the cost of any and all incidental required by job conditions as ordered by Construction Manager.

1.8 FIRE PREVENTION AND CONTROL

A. Each Contractor shall provide Fire Extinguishers as follows: Provide type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical fires or grease-oil-flammable liquid fires. In other locations provide either type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

1. All required exits, fire alarm, security, automatic temperature control, PA, sprinkler and similar systems shall be maintained and operable throughout the entire construction contract.

a. Contractor(s) will be back-charged for all fines imposed for false alarms or service calls.

B. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations. Portable fire extinguishers shall be provided by the Construction Contractor and made conveniently available throughout the construction site. Contractor(s) shall notify their employees of the location of the nearest fire alarm box at all locations where work is in progress.

C. Each Contractor shall take all possible precautions for the prevention of fires. Where flame cutting torches, blow torches, or welding tools are required to be used within the building, their use shall be as approved by the Construction Manager at the site. When welding tools or torches of any type are in use, have available in the immediate vicinity of the work a fire extinguisher of the dry chemical 20 lbs. Type. The fire extinguisher(s) shall be provided and maintained by the Contractor doing such work.

D. Fuel for cutting and heating torches shall be gas only and shall be contained in Underwriters laboratory approved containers.

E. Storage of gas shall be in locations as approved by the Construction Manager and subject to Fire Department regulations and requirements.

F. No volatile liquids shall be used for cleaning agents or as fuels for motorized equipment or tools within a building except with the express approval of the Construction Manager and in accordance with local codes. On-site bulk storage of volatile liquids shall be outside the buildings at locations directed by the Construction Manager, who shall determine the extent of volatile liquid allowed within the building at any given time.

G. Each Contractor shall comply with the following requirements relating to compressed gas:

1. Where compressed gas of any type is used for any purpose at the site, it shall be contained in cylinders complying with ICC regulations. Gases of different types shall not be stored together except when in use and when such proximity is required.

2. All gas cylinders shall be stored in sheds constructed of noncombustible materials. Sheds shall be well ventilated and without electric lights or fixtures and shall be located as far from other

buildings as is practicable. All gas cylinders not in actual use, or in proposed immediate use, shall be removed from the building under construction or reconstruction. Empty gas cylinders shall be removed prior to bringing in a replacement cylinder. Cylinders shall at all times be supported and braced in an upright position. When not in use, the protective cap shall be screwed over the valve.

3. All persons required to handle gas cylinders or to act as temporary firemen (Fire Watchers) shall be able to read, write and understand the English language; they shall also be required by the Contractor to read Part 3 of Pamphlet P-1 “Safe Handling of Compressed Gases” published by the Compressed Gas Association, 500 Fifth Avenue, New York, NY 10036.

4. Where local ordinances are in effect regarding gas cylinders, (their use, appurtenances and handling), such ordinances shall supplement the requirements of this paragraph. All personnel engaged in fire watch shall be certified by the Local Fire Department having jurisdiction.

5. LP-Gas Heating will not be permitted in enclosed areas below grade.

6. Any cylinder not having the proper ICC markings or reinspection marking, or any cylinder with a leak shall be isolated immediately away from any building and the supplier shall be immediately notified; such other precautions as may be required to prevent damage or injury shall also be taken by the Contractor.

1.9 PERSONNEL IDENTIFICATION

A. Provide identification badge or other approved identification to each Contractor's, project superintendent, employees, subcontractor’s directly or indirectly employed by the Contractor or persons authorized to enter premises.

B. Maintain a list of accredited persons, submit copy to Construction Manager on request.

C. Fingerprinting: The Contractor acknowledges and agrees that he/she or its employees may be subject to fingerprinting and a criminal history record check as may be required by the Educational Law of the State of State of New York. In such an event, Contractor agrees to cooperate with Construction Manager and to complete any and all forms or procedures, all at no cost or expense to the Edgemont Union Free School District.

1.10 RESTRICTIONS

A. Refer to Section 01 1000 - Summary of Contracts

B. Do not allow cameras on site or photographs taken except by written approval of Construction Manager.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. In the performance of its contract, each Contractor shall exercise every precaution to prevent injury to workers and the public or damage to property.

1. Each Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work to be done under this contract. Each

Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss including but not limited to:

a. All employees working in connection with this contract, and other persons who may be affected thereby.

b. All the work materials and equipment to be incorporated therein whether in storage on or off site; and including trees, shrubs, lawns, walks, pavements, facilities not designated for removal, relocation or replacement in the course of construction.

B. Each Contractor's duties and responsibilities for the safety and protection of the work: shall continue until such time as all the work is completed and contractor has removed all workers, material and equipment from the site, or the issuance of the certificate of final completion, whichever shall occur last.

C. Each Contractor shall use only machinery and equipment adapted to operate with the least possible noise, and shall so conduct his operations that annoyance to occupants of the site and nearby homes and facilities shall be reduced to a minimum

D. It shall be the responsibility of each Contractor to insure that all employees of the Contractor and all subcontractors, and any other persons associated with the performance of their contract shall comply with the provisions of this specification.

E. Each Contractor shall follow all rules and regulations put forth in the Code of Federal Regulations (OSHA Safety and Health Standards).

SECTION 01 3554
PREVAILING WAGE RATES

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General , Supplementary, and Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 PROVISIONS OF LAW DEEMED INSERTED

A. Each and every provision of law and clauses required by law to be inserted in the Contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party the Contract shall forthwith be physically amended to make such insertion.

B. The Contractor and subcontractors shall comply with applicable provisions of the Labor Law and all other state laws and Federal and Local statues ordinances, codes, rules and regulations and orders which are applicable to the performance of this contract. The Contractor shall likewise require all sub-contractors to comply therewith. The attention of the Contractor is particularly, but not exclusively, directed to Sections 220 through 223 of the New York State Labor Law and Sections 109 of the New York State Municipal Corporations Law and the following:

1. The Contractor shall post the prevailing wages in a conspicuous place on the job site.

2. Posters shall list the Department of Labor’s Public work field offices with telephone numbers.

C. All contractors and subcontractors shall furnish each of its workers with written notification of the applicable prevailing wage rates and supplements at the commencement of and at periodic intervals during the performance of the Work as required by the New York Labor Law

D. The Contractor shall provide and keep certified payroll records at the job site.

E. Prevailing Wages Schedule for this project can be obtained by the bidders on the DOL web site as follows:

1. http://www.labor.ny.gov/workerprotection/publicwork/PWContents.shtm.

2. Click on: "Request for Wage and Supplement Information" (PW39).

3. View "Previously Requested Prevailing Wage Schedule" using PRC# 2025011522

F. NOTE THESE WAGE RATES ARE EFFECTIVE UNTIL JUNE 30, of each year. Updated schedules will be available on the Department of Labor web site: www.labor.state.ny.us

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Quality assurance.

B. Testing and inspection agencies and services.

C. Control of installation.

D. Mock-ups.

E. Tolerances.

F. Manufacturers' field services.

G. Defect Assessment.

1.3 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Allowance for payment of testing services.

B. Section 01 3000 - Administrative Requirements: Submittal procedures.

C. Section 01 4219 - Reference Standards.

D. Section 01 6000 - Product Requirements.

1.4 REFERENCE STANDARDS

A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.

B. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2015a, with Editorial Revision (2016).

C. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2018.

E. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2015.

F. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2017.

1.5 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's General Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:

1. Temporary sheeting, shoring, or supports.

2. Temporary scaffolding.

3. Temporary bracing.

4. Temporary stairs or steps required for construction access only.

5. Temporary hoist(s) and rigging.

6. Investigation of soil conditions to support construction equipment or structure.

1.6 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

1. Submit a Request for Interpretation to Fuller and D'Angelo, P.C. if the criteria indicated are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1. Structural Design of Reinforcement Splices: As described in Division 3.

2. Structural Design of Formwork.

3. Structural Design of Metal Fabrications: As described in Section 05 5000 - Metal Fabrications.

1.7 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Designer's Qualification Statement: Submit for Construction Manager knowledge as contract administrator, or for Edgemont Union Free School District's information.

1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services by Contractor.

a. Full name.

b. Professional licensure information.

c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Testing Agency Qualifications:

1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

D. Design Data: Submit for Construction Manager's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

1. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

E. Test Reports: After each test/inspection, promptly submit one (1) copy of report to Architect and Construction Manager.

1. Include:

a. Date issued.

b. Project title and number.

c. Name of inspector.

d. Date and time of sampling or inspection.

e. Identification of product and specifications section.

f. Location in the Project.

g. Type of test/inspection.

h. Date of test/inspection.

i. Results of test/inspection.

j. Compliance with Contract Documents.

k. When requested by Architect and Construction Manager, provide interpretation of results.

2. Test report submittals are for Architect and Construction Manager's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

F. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor to Construction Manager, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Construction Manager.

G. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, for the Owner's Representative's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

H. Manufacturer's Field Reports: Submit reports for Architect and Construction Manager's benefit as contract administrator.

1. Submit report in PDF format within 30 days of observation to Architect, Construction Manager, and Contractor for information.

2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

2. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in New York.

1.9 REFERENCES AND STANDARDS - See Section 01 4219

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Edgemont Union Free School District will employ and pay for services of an independent testing agency to perform specified testing which is the responsibility of the Owner.

B. As indicated in individual specification sections, Contractor shall employ and pay for services of an independent testing agency to perform specified testing which is the responsibility of the Contractor.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. ContractorEmployed Agency:

1. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.

2. Laboratory: Authorized to operate in New York.

3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

3.2 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality for Architect and Construction Manager will use to judge the Work.

C. Notify Architect and Construction Manager five (5) working days in advance of dates and times when mock-ups will be constructed.

D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

F. Obtain Architect and Construction Manager's approval of mock-ups before starting work, fabrication, or construction.

1. Make corrections as necessary until Architect and Construction Manager's approval is issued.

G. Architect and Construction Manager will use accepted mock-ups as a comparison standard for the remaining Work.

3.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect and Construction Manager before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of the Contractor.

4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work.

3. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected.

b. To obtain and handle samples at the site or at source of Products to be tested/inspected.

c. To facilitate tests/inspections.

d. To provide storage and curing of test samples.

4. Notify Architect and Construction Manager and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

6. Arrange with Edgemont Union Free School District's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be shall be performed by the same agency on instructions by Construction Manager paid for by Contractor.

3.5 OWNER'S TESTING AND INSPECTIONS

A. Coordinate with Construction Manager.

B. Owner will engage a qualified testing agency or special inspector to conduct tests and inspections are the responsibility of Owner and paid for by Owner as follows:

1. Asbestos inspection and air monitoring
2. Compaction and backfilling.
3. Compaction of structural fill.
4. Slab on grade thickness and reinforcing placement.
5. Concrete samples and compression tests.
6. Placement of joint reinforcement.
7. Placement of anchors.
8. Shop fabrication and welding.
9. Welder's certificates.
10. Steel studs.
11. Size, placement and fasteners of light gauge metal framing.
12. Firestopping.
13. Commissioning. (See Section 01 2100 - Allowances)

C. Contractor shall perform the work in an efficient manner consistent with industry standards. Excessive testing resulting from the contractor's inability to perform efficiently will result in back charges to the contractor.

D. All re-inspections required for work not properly installed shall be paid for by the contractor.

E. The Owner will not be liable for any costs or delay claims due to the testing agency or special inspector failure to provide inspection without proper and sufficient notification.

F. All requests by the contractor for inspection that are cancelled and result in charges to the Owner will be back charged to the contractor.

3.6 CONTRACTOR'S TESTING AND INSPECTION

A. Testing and Inspections shall be conducted by a qualified testing agency or special inspector, approved by the Construction Manager as required by authorities having jurisdiction and as indicated in individual Specification Sections as the contractor's responsibility including but not limited to:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.

2. Notifying Construction Manager promptly of irregularities and deficiencies observed in the work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Construction Manager with copy to Contractor and to authorities having jurisdiction.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

6. All design mixes.

7. Testing and balancing of all mechanical and electrical.

8. Testing Fire Alarm

9. Testing technology data and communications systems.

10. Testing fire protection system.

11. Testing public address system.

12. Electrical systems.

13. Electrical Certification: The Electrical Contractor shall obtain UL Certification or Inspection from a Certified Electrical Organization for electrical installation.

14. Testing as required by individual specification sections.

3.7 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, adjusting as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions in writing to Architect and Construction Manager.

3.8 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Construction Manager, it is not practical to remove and replace the Work, Construction Manager will direct an appropriate remedy or adjust payment.

SECTION 01 4100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 GENERAL

A. Electrical Certification: The Electrical Contractor shall obtain UL Certification or Inspection from a Certified Electrical Organization for certification of electrical installations.

B. The Owner shall file and obtain the Building Permit.

C. The Contractor shall furnish and pay for all other permits, fees and other installation costs required for the various installations by governing authorities and utility companies; prepare and file drawings and diagrams required; arrange for inspections of any and all parts of the work required by the authorities and furnish all certificates necessary to the Architect and Construction Manager as evidence that the work installed under this Section of the Specifications conforms with all applicable requirements of the State Codes, National Board of Fire Underwriters, and National Electric Code.

D. Any items of work specified herein and shown on the drawings which conflict with aforementioned rules, regulations and requirements, shall be referred to the Architect for decision, which decision shall be final and binding.

E. The work shall not be deemed to have reached a Substantial Completion until the certificates have been delivered.

1.3 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project are the following:

1. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

2. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

3. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.

4. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

5. NFPA 1 - Fire Code; 2018.

6. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

7. New York State Uniform Fire and Building Codes known as the “Building Codes of the State of New York” and consist of the following:

a. State Education Department Planning Standards, including Commissioner's Regulation Part 155.5, 155.7

b. Energy Conservation Construction Code of New York State

c. Fire Code of New York State

d. Fuel Gas Code of New York State

e. Mechanical Code of New York State

f. Plumbing Code of New York State

g. Utility Company Regulations and Requirements.

h. Classification of Construction: Type IIB.

i. Occupancy Classification:Education E

j. State Education Department: Planning Standards is applicable to the work. Any conflicts between the Building Codes of New York and the State Education Department Planning Standards, the most restrictive shall apply. Copies of the Planning standards are available at the SED web site. http://www.p12.nysed.gov/facplan/

8. EPA - Environmental Protection Agency

9. IEEE - Institute of Electrical And Electronic Engineers

10. NEMA - National Electrical Manufacturers Association

11. UL - Underwriters Laboratories

12. OSHA Part 1926 Safety and Health Regulations for Construction.

13. Federal Regulation for Asbestos Abatement

a. Title 30 CFR Part 61, Subpart G; The Transport and Disposal of Asbestos Waste

b. The Transport and Disposal of Asbestos Waste]

c. Title 40 CFR, Part 763 Asbestos Containing Materials in Schools; Final Rule and Notice

d. Title 49 CFR Parts 106, 107, and 171-179.The Transportation Safety Act of 1974 and the Hazardous Material Transportation Act..

e. Public Law 101-637 ASHARA

14. New York State Official Compilation of Codes, Rules and Regulations

a. Title 12 Part 56

b. Title 10 Part 73

c. Title 6 Parts 360-364

d. Labor Law - Article 30 and Sections 900-912

e. All applicable Additions, Addenda, Variances and Regulatory Interpretation Memoranda

1.4 MANDATORY OSHA CONSTRUCTION SAFETY AND HEALTH TRAINING

A. All contractors and their subcontractor's project superintendent, employees, directly or indirectly employed by the contractor to work on the project must at all times, whenever on the Owner's property, wear an ID badge, safety vest, hard hat, etc. and all other required personal protective equipment as required by OSHA

1.5 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements.

B. Section 01 4219 - Reference Standards

C. Section 02 2080 - Asbestos Abatement.

D. Division 31 - Earthwork.

E. Division 32 - Exterior Improvements

F. Division 22 - Plumbing.

G. Division 23 - Heating, Ventilation and Air Conditioning.

H. Division 26 - Electrical.

I. Division 27 - Communications.

1.6 QUALITY ASSURANCE

A. Regulations: Each Contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.

2. Health and safety regulations.

3. Police, fire department and rescue squad rules.

4. Environmental protection regulations

B. Standards: Each Contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

C. Designer Qualifications: Where delegated engineering design is to be performed under the construction contract provide the direct supervision of a Professional Engineer experienced in design of this type of work and licensed in NY .

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 4219
REFERENCE STANDARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.3 RELATED REQUIREMENTS

A. Document 00 7200 - General Conditions: Reference standards.

1.4 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with the reference standard of date of issue specified in this section, except where a specific date is established by applicable code.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Fuller and D'Angelo, P.C. before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Fuller and D'Angelo, P.C. shall be altered by Contract Documents by mention or inference otherwise in any reference document.

1.5 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract and Section 01422 Definitions

1.6 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents, including reference standards in codes having jurisdiction, include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to Architect for a decision before proceeding.

C. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

D. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.

PART 2 CONSTRUCTION INDUSTRY ORGANIZATION DOCUMENTS

2.1 Abbreviations and Names:

A. Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries or the internet.

LIST OF REFERENCES

3.1 AAMA -- AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION

A. AAMA 1304 - Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems; 2018.

B. AAMA SFM-1 - Aluminum Storefront and Entrance Manual; 2014.

3.2 AASHTO -- AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 2017.

3.3 AATCC -- AMERICAN ASSOCIATION OF TEXTILE CHEMISTS & COLORISTS

3.4 ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 303R - Guide to Cast-in-Place Architectural Concrete Practice; 2012.

C. ACI 306R - Guide to Cold Weather Concreting; 2016.

D. ACI 440.1R - Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars; 2015.

E. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

F. ACI MNL-66 - ACI Detailing Manual; 2020.

3.5 AFPA -- AMERICAN FOREST AND PAPER ASSOCIATION

3.6 AI -- THE ASPHALT INSTITUTE

A. AI SS-2 - Specifications for Paving and Industrial Asphalts; 1995.

3.7 ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

A. ANSI/AWI 0641 - Architectural Wood Casework; 2019.

B. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).

C. ANSI/BHMA A156.29 - Standard for Exit Locks, Exit Alarms, Alarms for Exit Devices; 2017.

D. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

E. ANSI A224.1 - American National Standard Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1990.

F. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.; 2003.

G. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

H. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).

I. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

J. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

K. ANSI A300 Part 5 - American National Standard for Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance – Standard Practices. (Management Of Trees And Shrubs During Site Planning, Site Development, And Construction Operations); 2012.

L. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.

M. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

3.8 ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

A. ASHRAE (FUND)-2017 - ASHRAE Handbook - Fundamentals; 2017.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASHRAE Std 62.1-2019 - Ventilation for Acceptable Indoor Air Quality; 2019, with Errata and Amendments (2021).

3.9 ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

A. ASME A17.1 - Safety Code for Elevators and Escalators; 2016.

3.10 ASTM A Series -- ASTM INTERNATIONAL

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2018.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

C. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a (Reapproved 2017).

D. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

E. ASTM A526/A526M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality; 1990.

F. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2016.

G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018, with Editorial Revision (2018).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

I. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

J. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2016.

K. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

L. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

M. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.

N. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

O. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

P. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.

3.11 ASTM F Series -- ASTM INTERNATIONAL

A. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006 (Reapproved 2018).

B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

C. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2017.

D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).

E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

F. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015, with Editorial Revision (2016).

3.12 AWI -- ARCHITECTURAL WOODWORK INSTITUTE

A. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

B. AWI P-201 - Architectural Casework; 1989.

C. AWI P-206 - Guide to Wood Species; 1977.

D. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

3.13 AWPA -- AMERICAN WOOD-PRESERVERS' ASSOCIATION

A. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

3.14 BIA -- BRICK INDUSTRY ASSOCIATION

A. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

3.15 BICSI -- BUILDING INDUSTRY CONSULTING SERVICE INTERNATIONAL

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

3.16 CHPS -- COLLABORATIVE FOR HIGH PERFORMANCE SCHOOLS

A. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

3.17 EIA -- ELECTRONIC INDUSTRIES ALLIANCE

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Revision E, 2005.

3.18 GREENSEAL -- GREENSEAL, INC.

A. GreenSeal GS-36 - Adhesives for Commercial Use; 2013.

3.19 IAAF -- INTERNATIONAL AMATEUR ATHLETIC FEDERATION

3.20 IAS -- INTERNATIONAL ACCREDITATION SERVICE

A. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2017.

3.21 ICEA -- INSULATED CABLE ENGINEERS ASSOCIATION

A. ICEA S-83-596 - Indoor Optical Fiber Cables; 2016.

3.22 NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

A. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

B. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

C. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

D. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

E. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

3.23 NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

A. NFPA 1 - Fire Code; 2018.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2017.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

G. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

H. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

3.24 NRCA -- NATIONAL ROOFING CONTRACTORS ASSOCIATION

A. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; Fifth Edition, with interim updates.

3.25 PCI -- PRECAST/PRESTRESSED CONCRETE INSTITUTE

A. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.

3.26 PECI - PORTLAND ENERGY CONSERVATION, INC.

A. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests; Current Edition.

3.27 SDI -- STEEL DOOR INSTITUTE

A. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

3.28 SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

A. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

3.29 TIA -- TELECOMMUNICATIONS INDUSTRY ASSOCIATION

A. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).

B. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

C. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; 2015c.

D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2018.

E. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2016d.

F. TIA-569 - Telecommunications Pathways and Spaces; 2015d, with Addendum (2016).

G. TIA-598 - Optical Fiber Cable Color Coding; 2014d.

H. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2017c.

I. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2015c, with Addendum (2017).

3.30 TMS -- THE MASONRY SOCIETY

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

3.31 UL -- UNDERWRITERS LABORATORIES INC.

A. UL (DIR) - Online Certifications Directory; Current Edition.

B. UL (FRD) - Fire Resistance Directory; Current Edition.

C. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.

D. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

F. UL 444 - Communications Cables; Current Edition, Including All Revisions.

G. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

H. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

I. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

3.32 WCLIB -- WEST COAST LUMBER INSPECTION BUREAU

A. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2015.

3.33 WWPA -- WESTERN WOOD PRODUCTS ASSOCIATION

A. WWPA G-5 - Western Lumber Grading Rules; 2017.

SECTION 01 4516.13
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. The following is a list of standards which may be referenced in this Section:
   1. ASTM International (ASTM):
      a. D3740, Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
      b. E329, Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.2 DEFINITIONS

A. Contractor Quality Control (CQC): The means by which the Contractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the Contract.

1.3 SUBMITTALS

A. Informational submittals:
   1. CQC Plan: Submit, not later than 30 days after receipt of Notice to Proceed.
   2. CQC Report: Submit, weekly, an original and one copy in report form.

1.4 OWNER'S QUALITY ASSURANCE

A. All Work is subject to the Owner's quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the requirements of the Contract Documents.

B. Owner's quality assurance inspections and tests are for the sole benefit the Owner and do not:
   1. Relieve the Contractor of responsibility for providing adequate quality control measures.
   2. Relieve the Contractor of responsibility for damage to or loss of the material before acceptance.
   3. Constitute or imply acceptance.
   4. Affect the continuing rights of the Owner after acceptance of the completed Work.

C. The presence or absence of a quality assurance inspector does not relieve the Contractor from any Contract requirements.

D. Promptly furnish all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Engineer.

E. Owner may charge Contractor for any additional cost of inspection or test when Work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary.

F. Quality assurance inspections and tests will be performed in a manner that will not unnecessarily delay the Work.

PART 2 PRODUCTS

(Not used)

PART 3 EXECUTION

3.1 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure that the Work conforms to the requirements of the Contract Documents.

B. Maintain complete inspection records and make them available at all times to the Owner and Engineer.

C. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Contract Documents. The system shall cover all construction and demolition operations, both onsite and offsite, including Work by subcontractors, fabricators, suppliers, and purchasing agents, and shall be keyed to the proposed construction sequence.

3.2 COORDINATION MEETING

A. After the Preconstruction Conference, but before start of construction, and prior to acceptance of the CQC Plan, schedule a meeting with the Engineer and Owner to discuss the quality control system.

B. Develop a mutual understand of the system details, including the forms for recording the CQC operations, control activities, testing, administration of the

system for both onsite and offsite Work, and the interrelationship of the Contractor's management and control with the Owner's Quality Assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures that may require corrective action by the Contractor.

3.3 QUALITY CONTROL ORGANIZATION

A. CQC System Manager:
   1. Designate an individual within the Contractor's organization who will be responsible for overall management of the CQC and have the authority to act in CQC matters for the Contractor.
   2. The CQC System Manager may perform other duties on the Project.
   3. The CQC System Manager shall be an experienced construction professional, with a minimum of three years' construction experience on similar type Work.
   4. The CQC System Manager shall report to the Contractor's project manager or someone higher in the organization. The project manager in this context shall mean the individual with responsibility for the overall quality and production management of the Project.
   5. The CQC System Manager shall be onsite during construction; periods of absence may not exceed 2 weeks at any one time.

B. CQC Staff:
   1. Designate a CQC staff, available at the Site at all times during progress, with complete authority to take any action necessary to ensure compliance with the Contract. CQC staff members shall be subject to acceptance by the Engineer.
   2. CQC staff shall take direction from CQC System Manager in matters pertaining to QC.
   3. CQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
   4. The actual strength of the CQC staff may vary during any specific Work period to cover the needs of the Project. Add additional staff when necessary for a proper CQC organization.

C. Organizational changes: Obtain the Engineer's acceptance before replacing any member of the CQC staff. Requests for changes shall include name, qualifications, duties, and responsibilities of the proposed replacement.

3.4 QUALITY CONTROL PHASING

A. CQC shall include at least three phases of control to be conducted by the CQC System Manage for all definable features of the Work, as follows:

1. Preparatory Phase:
   a. Notify Owner at least 48 hours in advance of beginning any of the required action of the preparatory phase.
   b. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The CQC System Manager shall instruct applicable CQC staff as to the acceptable level of workmanship required in order to meet Contract requirements.
   c. Document the results of the preparatory phase meeting by separate minutes prepared by the CQC System Manager and attached to the QC report.
   d. Perform prior to beginning Work on each definable feature of the Work:
      1) Review applicable Contract Specifications.
      2) Review applicable Contract Drawings.
      3) Verify that all materials and/or equipment have been tested, submitted, and approved.
      4) Verify that provisions have been made to provide required control inspection and testing.
      5) Examine the Work area to verify that all required preliminary Work has been completed and is in compliance with the Contract.
      6) Perform a physical examination of required materials, equipment, and sample Work to verify that they are on hand, conform to approved Shop Drawings or submitted data, and are properly stored.
      7) Review the appropriate activity hazard analysis to verify safety requirements are met.
      8) Review procedures for constructing the Work, including repetitive deficiencies.
      9) Document construction tolerances and workmanship standards for that phase of the Work.
      10) Check to verify that the plan for the Work to be performed, if so required, has been accepted by the Engineer.
2. Initial phase:
   a. Accomplish at the beginning of a definable feature of Work:
      1) Notify the Owner at least 48 hours in advance of beginning initial phase.

2) Perform prior to beginning Work on each definable feature of Work:
   a) Review minutes of the preparatory meeting.
   b) Check preliminary Work to verify compliance with Contract requirements.
   c) Verify required control inspection and testing.
   d) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards.
   e) Resolve all differences.
   f) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
3) Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
4) The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3. Follow-up phase:
   a. Perform daily checks to verify continuing compliance with Contract requirements, including control testing, until completion of the particular feature of Work.
   b. Daily checks shall be made a matter of record in the CQC documentation and shall document specific results of inspections for all features of the Work for the day or shift.
   c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.
4. Additional Preparatory and Initial phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by the Owner if the quality of ongoing Work is unacceptable or if there are changes in the applicable QC staff or in the onsite production supervision or work crew, or if Work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.5 CONTRACTOR QUALITY CONTROL PLAN

A. General:
   1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.

2. An interim plan for the first 30 days of operation will be considered.
3. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
4. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:
1. Plan shall cover the intended CQC organization for the entire Contract and shall include the following, as a minimum:
   a. Organization: Description of the quality control organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three-phase control system for all aspects of the Work specified.
   b. CQC Staff: The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.
   c. Letters of authority: A copy of a letter to the CQC System Manager signed by an authorized official of the firm, describing the responsibilities and delegating sufficient authorities to adequately preform the functions of the CQC System Manager, including authority to stop Work which is not in compliance with the Contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives, outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to the Owner.
   d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents.
   e. Testing: Control, verification, and acceptance testing procedures for each specific test to include the test name frequency, specification paragraph containing the test name, frequency, personnel and laboratory responsible for each type of test, as estimate of number of tests required.
   f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.
   g. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats; include a copy of the CQC report form.

C. Acceptance of Plans: Acceptance of the Contractor's basis and addendum CQC plans is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Owner reserves the right to require the Contractor to make changes in the CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of changes: After acceptance of the CQC plan, the Contractor shall notify the Engineer, in writing, a minimum of 7 calendar days prior to any proposed change. Proposed changes are subject to the Engineer's acceptance.

3.6 CONTRACTOR QUALITY CONTROL REPORT

A. As a minimum, prepare a CQC report for every 7 calendar days. Account for all days throughout the life of the Contract. Reports shall be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of subcontractors and suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, the results of inspections, daily activities, tests, and other items, including but not limited to the following:

1. Contractor/subcontractor area of responsibility.
2. Operation plant/equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom. When a network schedule is used, identify each phase of Work performed each day by activity number.
4. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
5. Material received with statement as to its acceptability and storage.
6. Identify submittals reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. List instructions given/received and conflicts in Drawings and/or Specifications.

10. Contractor's verification statement.
11. Indicate a description of trades working on the Project, the number of personnel working, weather conditions encountered, and any delay encountered.
12. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in file work and workmanship comply with the Contract.

3.7 QUALITY CONTROL SUBMITTALS

A. The CQC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements.

B. The Owner will furnish copies of test report forms upon request by the Contractor.

C. Contractor may use other forms, as approved.

3.8 QUALITY CONTROL TESTING

A. Testing procedure:
   1. Perform tests specified or required to verify that control measures are adequate to provide a product which conforms to the Contract requirements.
   2. Perform the following activities and record the following data:
      a. Verify testing procedures comply with Contract requirements.
      b. Verify facilities and testing equipment are available and comply with testing standards.
      c. Check test instrument calibration data against certified standards.
      d. Verify recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
      e. Documentation:
         1) Record results of all tests taken, both passing and failing, on the CQC report for the date taken.
         2) Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test.
         3) Actual test reports may be submitted later, if approved by the Engineer, with a reference to the test number and date taken.
         4) Provide directly to the Engineer an informational copy of tests performed by an offsite or commercial test facility. Test results shall be signed by an engineer registered in the state where tests are performed.

5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility in the Contract.

B. Testing laboratories:
1. Laboratory facilities, including personnel and equipment utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D3740 and ASTM E329, and shall be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority.
2. Personnel performing concrete testing shall be certified by the American Concrete Institute (ACI) and National Institute for Certification in Engineering Technologies (NICET).

3.9 COMPLETION INSPECTION

A. The CQC System Manager shall conduct an inspection of the Work at the completion of all Work or any milestone established by a completion time stated in the Contract.

B. Punch list:
1. The CQC System Manager shall develop a punch list of items which do not conform to the Contract requirements.
2. Include punch list in the CQC report, indicating the estimated date by which the deficiencies will be corrected.
3. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have be corrected and so notify the Owner.
4. These inspections and any deficiency corrections required will be accomplished within the time stated for completion of the entire Work or any particular increment thereof if the Project is divided into increments by separate completion dates.

++END OF SECTION++

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SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Dewatering facilities and drains.

B. Temporary utilities.

C. Water service and distribution.

D. Temporary water.

E. Temporary electric power.

F. Temporary heat.

G. Ventilation.

H. Temporary sanitary facilities.

I. Temporary Controls: Barriers, enclosures, and fencing.

J. Enclosure fence for the construction site.

K. Dust control.

L. Vehicular access and parking.

M. Waste removal facilities and services.

N. Construction aids and miscellaneous services and facilities.

O. Environmental protection.

1.3 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements for submittals.

B. Section 01 3553 - Site Safety and Security Procedures

C. Section 01 5213 - Field Offices and Sheds.

D. Section 01 5500 - Vehicular Access and Parking.

E. Section 01 5510 - Traffic and Pedestrian Access & Control

F. Section 01 7419 - Construction Waste Management and Disposal.

G. Section 01 5813 - Temporary Project Signage.

H. Section 01 7000 - Execution progress cleaning and construction layout.

I. Division 32 Earthwork for disposal of ground water at Project site.

J. Division 32 Asphalt Unit Paving" for construction and maintenance of asphalt paving for temporary roads and paved areas.

1.4 REFERENCE STANDARDS

A. Refer to Section 01 4219 - Reference Standards.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

1.5 DEWATERING

A. Provide temporary means and methods for dewatering all temporary facilities and controls.

B. Maintain temporary facilities in operable condition.

1.6 SITE PLAN:

A. Show exiting fencing, temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.7 REPORTS AND PERMITS:

A. Refer to 01 3000 - Administrative Requirements and 01 4100 - Regulatory Requirements.

1.8 QUALITY ASSURANCE

A. Refer to Section 01 4000 Quality Requirements.

B. Regulations: Refer to 01 4100 Regulatory Requirements.

C. Standards: Refer to 01 4219 Reference Standards.

1.9 PROJECT CONDITIONS

A. General: Each Contractor shall provide each temporary service and facility ready for use at each location, when first needed to avoid delays in performance of work. Maintain, expand as required, and modify as needed throughout the progress of the work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.

B. Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload, and do not permit temporary services and facilities to interfere with the progress of work, or occupancy of existing facility. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.

C. Temporary Utilities: Do not permit freezing of pipes, flooding or the contamination of water sources.

D. Temporary Construction and Support Facilities: Maintain temporary facilities in a manner to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary facilities in a sanitary manner so as to avoid health problems.

E. Security and Protection: Maintain site security and protection facilities in a safe, lawful, publicly acceptable manner. Take measures necessary to prevent site erosion.

1.10 TEMPORARY UTILITIES

A. Edgemont Union Free School District will provide the following:

1. Electrical power consisting of connections to existing facilities.

2. Water supply, consisting of connections to existing facilities.

B. Provide for all electrical power, lighting, and water required for construction purposes.

C. Existing facilities may be used.

D. New permanent facilities may be used if approved by the Construction Manager.

E. Use trigger-operated nozzles, with back flow devices, for water hoses, to avoid waste of water.

F. Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Comply with utility company recommendations. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24 hour day basis where required to achieve indicated results in the work and avoid the possibility of damage to work or the temporary facilities at no additional cost to the Owner.

2. Arrange with the company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.

3. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

a. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose

1.11 DIVISION OF RESPONSIBILITIES

A. Each Contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, as well as the costs and use charges associated with each facility.

2. Plug-in electric power cords and extension cords.

3. Supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.

4. Special power requirements for installation of its own work such as welding.

5. Its own field office complete with necessary furniture, utilities, and telephone service.

6. Its own storage and fabrication sheds.

7. Temporary telephone service.

8. Temporary heat, ventilation, humidity control, and enclosure of the building where these facilities are necessary for its construction activity but have not yet been installed by the responsible Prime Contractor.

9. All hoisting and fencing for its own work.

10. Collection and disposal, off site, of its own hazardous, dangerous, unsanitary, or other harmful waste material.

11. **Collection and disposal of major equipment removed such as unit ventilators, heaters, fans, toilet fixtures, light fixtures, and other major equipment.**

12. Collection and disposal of major equipment removed such as unit ventilators, heaters , fans, toilet fixtures , light fixtures, and HV equipment.

13. Collection of general waste and debris and disposing into containers provided by the Contract #1 General Construction.

14. Secure lockup of its own tools, materials and equipment.

15. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

B. The Site Contractor is responsible and pays all costs for the following:

1. Temporary roads and paving.

2. Temporary toilets, including disposable supplies.

3. Temporary heat.

4. First Aid Station and Supplies.

5. Containers for non-hazardous waste and debris.

6. Temporary enclosure of the building.

7. Project temporary project signs.

8. Disposal of wastes containers.

9. Rodent and pest control.

10. Barricades, warning signs, and lights.

11. Site/construction enclosure fence.

12. Sidewalk bridge and fence.

13. Security enclosure and lockup.

14. Temporary Protection for existing flooring, within and from altered areas to exits.

15. Construction aids and miscellaneous services and facilities.

16. Temporary dustproof partitions.

17. Temporary dust control.

C. Water Service: The Contract #2 Plumbing shall provide and pay all costs to install distribution piping of sizes and pressures adequate for construction .

1. As soon as construction operations at each floor level require water, extend service, the full height of the building to form a temporary water and fire water standpipe. Provide distribution piping for temporary water to each location of use. Provide one outlet for each level of construction spaced so that water can be reached with a 100 foot length of hose. Provide one 3/4" flexible rubber hose 100 feet long with an adjustable nozzle, at each outlet where work requiring water is in progress.

2. Provide backflow devices to prevent water from re-entering the potable system.

3. Maintain hose connections and outlet valves in leak-proof condition. Where finish work below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize the possibility of water damage. Drain water promptly from drip pans as it accumulates.

4. Pumping: Where temporary water pressure is inadequate to provide at least 20 psig pressure at the highest point of use, provide temporary water pumps as necessary to supply the required flow of water and to provide a minimum of 30 psig static pressure at the highest point of use. Equip pumps with adequate surge and storage tanks and automatic controls to supply water uniformly, at reasonable pressures.

    a. Sterilization: Except piping of non-potable water, sterilize temporary water piping prior to use. Refer to Division 22 sections for procedures.

5. Maintaining existing domestic hot and cold water systems, sanitary and storm systems, fire protection systems within the existing building operational at all times for Owner's occupancy and during construction.

6. Applicability: This section applies to all renovation and new construction work areas for this Project.

D. The Contract #3 Mechanical Contractor is responsible and pays all costs for the following:

1. Maintaining existing heating system in service during the period between September 15 and June 15. Contractor shall provide all piping, valves, controls, etc., and labor and materials required to maintain operation of existing heating system where affected by the work.

E. Temporary Electric Power Service: Contract #4 Electrical Contractor shall provide and pay all costs to provide a weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period

1. Applicability: This section applies to all renovation and new construction work areas for this Project.

2. Connect temporary service to Owner's existing main in the manner directed by Construction Manager.

3. The Contractor shall maintain all parts of the electrical system temporary and permanent active and in-service at all times throughout the contract duration. All temporary lighting and power to be controlled by standard switches per code (outside of power panels) at no additional charge.

4. Temporary Service: Install service and grounding in compliance with the National Electric Code (NFPA 70). Include necessary meters, transformers, overload protected disconnect and main distribution switch gear. Comply with all NECA, NEMA and UL Standards.

5. Provide temporary service with an automatic ground-fault interrupter feature, activated from the circuits of the system.

6. Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead. Rise vertically where wiring will be least exposed to damage from construction operations.

7. Contract #4 Electrical Contractor shall provide temporary generator power where Owner's electricity in not available. Contractor shall include required fuel for operation.

8. Provide metal conduit, tubing or armored cable for protection of temporary power wiring where exposed to possible damage during construction operations. where permitted by code, wiring of circuits not exceeding 110-120 Volt 20 Amp rating and wiring of lighting circuits may be non-metallic sheathed cable in areas where located overhead and exposed. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide metal enclosures or boxes for wiring devices.

9. Provide overload-protected disconnect switch as required by code.

10. Temporary power for new corridors, stairways and other exit ways

F. Temporary Lighting: Contract #4 Electrical Contractor shall provide and pay all costs to provide local switching of temporary lighting, spaced to allow lighting to be turned off in patterns to conserve energy, retain light suitable for work-in-progress, access traffic, security check and project lock-up

1. Provide not less than on 200-watt lamp per 400 sq. ft. of floor area, uniformly distributed, for general construction lighting, or illumination of a similar nature.

   a. In corridors and similar traffic areas provide one 100-watt incandescent lamp every 50 feet.

   b. In stairways and at ladder runs, provide one lamp per story, located to illuminate each landing and flight.

c. Provide separate circuitry for corridors, stairways and other travel exits.

2. Operate corridors, stairways and other travel exits 24 hours per day 7 days per week on each level.

a. Install and operate temporary lighting to fulfill security and protection requirements, without the necessity of operating the entire system

3. Temporary lighting for sidewalk bridges.

G. Whenever an overhead floor or roof deck has been installed, install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every work area

H. Temporary light and power shall be provided 15 minutes before the normal scheduled daily start of any trade and 15 minutes after the normal schedule daily completion of the last trade.

I. The Electrical Contractor shall maintain power and lighting during the normal work week during the hours established by Construction Manager whether or not they fall within established working hours.

1.12 MAXIMUM LOADS

A. General: Lighting and power loads connected to the temporary power distribution system shall be limited to the following maximum individual loads:

	Load	Type	Maximum Size
2.	120 volt	1-phase	1.5 KVA
3.	208 volt	1-phase	2.5 KVA
4.	208 volt	3-phase	5.0 KVA

B. General: The temporary power distribution system shall be sufficiently sized to provide temporary power as required within this section. Meter and Meter connections to be part of electrical contractor.

1.13 ELECTRIC WELDERS

A. Separate Power Sources Required: Power for electric welders and for other loads larger than the maximum allowable sizes shall be taken from portable power sources provided, paid for and operated by the Contractor or Sub-Contractor requiring the use of such equipment. Remove such power sources when no longer needed.

1.14 USE CHARGES

A. General: Cost for temporary facilities are not chargeable to the Owner, Architect, and Construction Manager. The Owner, Architect, and Construction Manager will not accept a contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.

1. Water Service Use Charges: Water from the Owner’s existing water system may be used without metering, and without payment for use charges.

2. Electric Power and Lighting Service Use Charges: Electric power from the Owner's existing system may be used without payment of use charges. Contractor and Sub-Contractors shall exercise measures to conserve energy usage.

    a. Use of owner electric for items not specific to project (e.g. heating construction shanties, etc.) will not be permitted.

3. All temporary lighting and power to be controlled by standard switches per code (outside of power panels) at no additional charge.

4. Temporary Utility Services: Where Owner's existing services is inadequate or would disrupt owners use of the existing facility, Contract #4 Electrical Contractor shall provide utility services for the temporary use at the project site from the utility company, and pay all costs, including use charges.

5. Each Contractor is responsible for providing adequate utility capacity at each stage of construction for temporary services required under its contract. Prior to availability of temporary utility services at the site, provide trucked-in services for start up of construction operations.

6. Contractor may elect to use alternative temporary services and facilities equivalent to those specified, subject to acceptance by the Architect.

1.15 TELECOMMUNICATIONS SERVICES

A. Each Contractor shall provide and pay for its own telephone service consisting of mobile phone service for all field superintendents and foreman.

B. Temporary Telephones: Contract #1 General Construction shall arrange and pay all costs including usage costs for the local telephone company to install temporary service to the project. Provide service of the type and capacity as follows:

1. Install three separate lines, one for facsimile machine and two for voice, for General Construction temporary field office, two telephone instruments. (One instrument shall be portable.)

2. Install a pay-telephone station at grade level, for the convenience of personnel at the site.

C. At Contractor's Field Office location post a list of important telephone numbers, including the following:

1. Local police and fire department.

2. Doctor.

3. Ambulance service.

4. Each Contractor's temporary and home office.

5. Construction Manager temporary and home office

6. Architect's home office.

7. Owner's home office.

8. Principal subcontractors temporary and home office

1.16 TEMPORARY SANITARY FACILITIES

A. Responsibilities: The Each Contractor is responsible for temporary sanitary facilities and their maintenance, including supplies

B. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

C. Use of existing facilities is not permitted.

D. Maintain daily in clean and sanitary condition.

E. Sanitary Facilities: Sanitary facilities include temporary toilets. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations which will best serve the project's needs.

1. Locate toilets and drinking water fixtures so that no one within the construction area will need to walk more than 2 stories vertically or 200 feet horizontally to reach these facilities.

2. Install self-contained toilets to the extent permitted by governing regulations.

3. Supply and maintain toilet tissue, paper towels, paper cups and other disposable materials as appropriate for each facility for full contract duration. Provide covered waste containers for used material.

1.17 BARRIERS

A. Responsibility: Site Contractor Contractor shall be responsible for construction barriers required for the project.

B. Barricades, Warning Signs and Lights: Comply with recognized standards and code requirements for erection of substantial, structurally adequate barricades where needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the public, of the hazard being protected against. Provide lighting where appropriate and needed for recognition of the facility, including flashing red lights where appropriate

1. Sign Materials: For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated. Provide exterior grade acrylic-latex-base enamel for painting sign panels and applying graphics.

C. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and removals .

1.18 SIDEWALK BRIDGES

A. Sidewalk Bridge: General: Erect a substantial structurally adequate protective bridge for passage of persons along exits from existing building when overhead work is being performed. Coordinate with project entrance gates and other facilities and obstructions. Comply with governing regulations and requests of governing authorities.

1. Responsibility: Sidewalk bridge required for the project shall be the responsibility of Site Contractor

2. Shop drawings for safety fence and sidewalk bridges showing the locations, dimensions, and details for all components and assemblies of the safety fence and sidewalk bridges.

    a. Sidewalk Bridges shop drawings shall be signed, sealed and stamped by a professional engineer licensed in New York State.

3. Shall be designed for live load of 100 lbs/sf. and meet the following minimum requirements:

4. Prior to overhead construction at exit ways construct sidewalk bridges as follows:

    a. Tubular metal sections, or other non-combustible material, to meet at a minimum the NYS Building Code, and OSHA requirements.

        a) Lumber used in the erection of the scaffold or sidewalk bridges shall be at least equal in strength and quality to construction grade Douglas fir, and treated with a recognized fire retardant.

        b) Fasteners to secure lumber and timber shall be galvanized nails or bolts of a suitable size to produce a secure joint capable of withstanding the design load.

        c) Mud sills shall be 2 X 10 inch wood planks.

    b. Brace and securely attach all components.

    c. Fence - ¼" plywood.

        a) The bridge shall be braced longitudinally and horizontally with X-bracing every fifth bay and each end bay. Transverse bracing is provided 8' o.c. at post beam junctions

1.19 FENCING

A. Enclosure Fence: General: Prior to start of excavation or other substantial elements of work begin, install a general enclosure fence with suitable lockable entrance gates. Locate where indicated, or if not indicated, enclose the entire site or the portion of the site determined to be sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except through entrance gates.

    1. The Site Contractor shall provide, maintain and pay all costs for temporary fencing until directed to remove fence from the site

B. Construction: Commercial grade chain link fence.

C. Provide 8 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

D. Locate where indicated, or if not indicated, enclosed portions of the site determined to be sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except through entrance gates.

1. Material:

   a. Steel fencing: Galvanized Chain Link and galvanized gates (non-climbable size).

   b. Fabric: No. 9 GA galvanized, steel wire mesh, furnish one-piece fabric widths for fencing up to 12' in height indicated in the Contract Documents.

   c. Framing and Accessories: End, Corner and Pull posts: 2.375" OD steel pipe.

   d. Line Posts: Space 10'-0" O.C. maximum. 1.90" steel pipe or 1.875" x 1.625 C-sections.

   e. Fence Rails: Locate at top and bottom of fabric. Post brace assembly - manufacturer's standard.

   f. Wire ties: For tying fabric to line posts use wire ties spaced 12" O.C.

   g. Height: 6'

2. Excavate hole depths approximately 3" lower than post bottom; with bottom of posts set not less than 36" below finish grade surface. The line post holes will be 16" in diameter and 3'-9" in depth filled with set in a compacted mixture of gravel and earth.

   a. Self-supporting fence with movable bases may be used only when and where approved by the Owner's Representative.

1.20 EXTERIOR ENCLOSURES

A. Responsibilities: Contract #1 The contractor for SIte is responsible for temporary enclosure.

B. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

C. Provide temporary enclosures where temporary heat is needed and permanent building enclosure is not yet completed, and there is no other provision for containment of temporary heat. Coordinate enclosures with ventilating and material drying or curing requirements to avoid dangerous conditions and adverse effects.

D. Enclosure: Install tarpaulins or equivalent materials securely, using a minimum of metal framing, 4" - 20 ga. metal framing 16” o.c., and ½” plywood plus 6 mil poly for secure and weather tight protection of the school. Individual openings of 16-sq. ft. or less may be closed with plywood or similar materials.

   1. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures where work is being or will be performed, provide translucent tarpaulins made of nylon reinforced laminated polyethylene to admit the maximum amount of daylight and reduce the need for temporary lighting

E. Close openings through floor and roof deck and other horizontal surfaces with substantial load-bearing metal framing or similar construction

1.21 INTERIOR ENCLOSURES

A. Refer to Section 02 2080 Asbestos Abatement for additional requirements.

B. Temporary Dustproof Partitions: Contract #1 General Construction Contractor shall provide dustproof partitions to separate work area from occupied sections of building. Partitions shall be full height metal stud surfaced with minimum 1/2" Type X gypsum board with 2 layers of poly sheeting, overlapped and edges caulked.

1. Where isolated work is being performed by a Prime Contractor(s) the contractor performing the work shall be responsible for protecting the occupied areas from the work areas as directed by the Construction Manager, including providing dust protection.

2. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.

3. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.

4. Where temporary wood or plywood enclosure exceeds 100sq. Ft. (9.2 sq. m) in area, use fire-retardant-treated material for framing and main sheathing.

C. Contract #1 General Construction Contractor will install these 9’x12’ fire rated temporary partitions at the corridor connection points in the existing building as indicated on drawings. Each location will be equipped with a 3' x 7' hollow metal door and frame with a lockable panic device and door closer.

D. Contractor shall remove and reinstall any devices impacted by temporary partition installation. At conclusion of project the Contractor will again remove and reinstall these devices onto the permanent locations

E. Refer to Section 01 7330 - Selective Removals for additional requirements.

1.22 SITE SAFETY AND SECURITY PROCEDURES

A. Security and Protection Facilities and Services shall be the responsibility of the each contractor Contractor and all costs shall be included in their bid.

B. Provide security and facilities to protect Work, existing facilities, and Edgemont Union Free School District's operations from unauthorized entry, vandalism, or theft.

C. Coordinate with Edgemont Union Free School District's security program.

D. Security Enclosure and Lockup: Install substantial and durable general temporary enclosure of partially completed areas of construction. Provide locking entrances adequate to prevent unauthorized entrance, vandalism, theft and similar violations of project security.

E. Temporary Fire Protection: Each Contractor shall provide Fire Extinguishers as follows:: Provide type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical fires or grease-oil-flammable liquid fires. In other locations provide either type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case

F. The existing building contains a security alarm system maintained and operated by the Owner. Access into the existing building shall not be permitted unless the owner is notified and arrangements made to deactivate the system.

1.23 VEHICULAR ACCESS AND PARKING

A. See Section 01 5500.

1.24 WASTE REMOVAL

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Contract #1 General Construction Contractor shall provide containers, at grade, sufficient for the depositing of non- hazardous/non-toxic waste materials, and shall remove such waste materials from project site as required or directed by the Construction Manager.

1. Provide specific containers for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

2. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

3. Contractors shall not utilize the Owner's bins or dumpsters.

C. Contract #5 Site Contractor shall provide their own containers for their work only.

D. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

F. Contract #1 General Construction Contractor shall be responsible for daily cleaning up of spillage and debris resulting from its operations and from those of its subcontractors; and shall be responsible for complete removal and disposition of hazardous and toxic waste materials:

1. Broom clean the work area at the end of each work day.

2. Remove liquid spills promptly.

3. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

G. Contract #5 Site contractor shall be responsible for daily clean up for the exterior site areas.

H. Burying or burning of waste materials on the site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. Site: The Site Contractor shall maintain Project site free of waste materials and debris.

J. Installed Work: Keep installed work clean. Each Contractor shall clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

K. Concealed Spaces: Each contractor shall remove debris from concealed spaces before enclosing the space.

L. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

M. If daily cleaning and dust protection is not provided the Contractor will be back charged for cleanup performed by employees of the Owner or a separate contractor retained by the Owner.

1.25 PROJECT SIGNS - See Section 01 5813

1.26 FIELD OFFICES

A. See Section 01 5213.

1.27 TEMPORARY HEAT

A. Temporary Heat: General: Provide temporary heat as required for proper performance of the Work, curing or drying of recently installed work or protection of work in place from adverse effects of low temperatures or high humidity. Select facilities known to be safe and without deleterious effect upon work in place or being installed. Coordinate with ventilation requirements to produce indicated ambient condition required and to minimize consumption of fuel or energy.

1. All temporary heat required within the perimeter of the building being erected, or within the completed or uncompleted walls of the building being erected, shall be the responsibility of the Contract #1 General Construction Contractor and complete costs therefore shall be borne by them and included in the amount quoted in his proposal for all temporary heating described in this section.

2. Contract #1 General Construction Contractor shall enclosed the area within the perimeter of the building, or the required portion of that area, with temporary, legal and fire-resistant construction which will retain temporary heat within that area, if the exterior walls are not erected. He shall do so when directed by the Architect or Construction Manager in order to comply with the progress schedule, and to protect work or materials previously placed, being placed, or about to be placed from damage that could result from cold weather.

3. All other contractors shall be responsible for temporary heat required to comply with the progress schedule and protect their work and materials on the site, but beyond the perimeter or beyond the completed or uncompleted walls of the building or buildings in this project.

4. When the building or a section thereof is enclosed, or when temporary heating is required for the proper progress or protection of the work as determined by the Construction Manager the General Construction Contractor shall provide temporary heating.

5. Maintain a minimum temperature of 55 degF in permanently enclosed portions of the building and areas where finished work has been installed. Refer to individual sections for more stringent requirements.

6. Heating Facilities: Except where conditions make it necessary to use another system, provide properly vented self-contained LP gas heaters with individual space thermostatic control for temporary heat.

a. Gasoline burning space heaters will not be permitted.

b. Electric space heaters will not be permitted.

c. Do not use open burning, electric or salamander type temporary heating units

1.28 HOISTS AND TEMPORARY ELEVATOR USE

A. Each Contractor shall provide facilities for hoisting materials and employees. Do not permit employees to ride hoists which comply only with requirements for hoisting materials. Selection of type, size and number of facilities is the Contractor's option. Truck cranes and similar devices used for hoisting are considered tools and equipment and not temporary facilities.

B. Elevator Use: Owner's existing elevator may not be used by the Contractor.

1.29 MISCELLANEOUS PROVISIONS

A. Temporary Floor Protection: Contract #1 General Construction shall provide protective floor covering from and within construction work areas to all floors leading to outside the construction area thru all finish area used by the or each Contractor(s).

1. Heavy-duty, temporary floor protection "Ram Board" reusable and recyclable.

2. Handling and storage in accordance with manufacturer's recommendations.

3. Tape all joints

4. All corridors from renovated areas to exitways, used by Contractors, shall be mopped and left clean daily by the Contract #1 General Construction Contractor

1.30 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Clean and repair damage caused by installation or use of temporary work.

B. Restore existing facilities used during construction to original condition.

C. Restore new permanent facilities used during construction to specified condition.

D. Unless the Construction Manager requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it has ended, or when it has been replaced by authorized use of a permanent facility, or no later than the Date of Substantial Completion. If necessary, restore permanent work which may have been delayed because of interference with the temporary service or facility. Repair damaged work, clean exposed surfaces and replace work which cannot be satisfactorily repaired

E. Remove temporary roads and paving materials not intended for or acceptable for integration into permanent paving. Where the area shown is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the landscape area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair plant materials or lawns. Repair or replace street paving, curbs and sidewalks at temporary entrances, as required by the governing authority, and/or restore to original condition

PART 2 PRODUCTS - NOT USED

2.1 DE - WATERING FACILITIES AND DRAINS

A. The Site Contractor is directly responsible for de-watering their excavations. The responsibility of de-watering of the site as to facilitate the work will be the responsibility of the The Site Contractor coordinate with Construction Manager.

1. Dispose of rainwater in a lawful manner that will not result in flooding project or adjoining property nor endanger permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.

2. Remove snow and ice as required to minimize accumulations.

PART 3 EXECUTION -

3.1 TEMPORARY INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.

B. Each Contractor shall provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

3.2 STAGING

A. All staging thereto shall comply in total to the requirements of Safety and Health Regulations for Construction Chapter XVII of OSHA, Part 1926 and all related amendments.

B. Install and maintain staging and appurtenances where roofing and window replacement work is specified until all work and punch list work is complete and approved by the Construction Manager.

3.3 ROOF PROTECTION

A. Each Contractors shall provide temporary protection on any newly installed and existing roof surface when it is necessary for work to take place on completed sections.

3.4 FIRE PREVENTION AND CONTROL

A. Refer to Section 01 3553 - Site Safety and Security Procedures.

3.5 DISCONTINUE, CHANGES AND REMOVAL

A. Each Contractor shall:

1. Discontinue all temporary services required by the Contract when so directed by the Construction Manager.

2. The discontinuance of any such temporary service prior to the completion of the work shall not render the Owner liable for any additional cost entailed thereby and each Contractor shall thereafter furnish, at no additional cost to the Owner, any and all temporary service required by such Contractor(s) work.

3. Remove and relocate such temporary facilities as directed by the Construction Manager without additional cost to the Owner, and shall restore the site and the work to a condition satisfactory to the Owner.

3.6 VENTILATION AND HUMIDITY CONTROL FOR CONSTRUCTION

A. Refer to Section 01 5719 - Temporary Environmental Controls.

B. Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

C. Contract #1 General Construction Contractor shall be responsible for temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.

D. Ventilate enclosed area to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.

E. Provide equipment as necessary for air and fresh exchange for the work area per OSHA standards.

F. Remove temporary ventilation equipment prior to the completion of construction.

G. Contract #1 General Construction Contractor will provide negative air machines of sufficient size / qty for square footage of work areas to exhaust any dust / fumes through flexible duct hose to exterior to eliminate any odors/smoke etc. During second shift work, there can be no odors in school the following day.

H. The contractor who allows water infiltration into the building is responsible for cleanup and commercial dehumidifiers of sufficient size and quantity to prevent mold growth. Failure to immediately address will result in owner hiring others and back-charging in order to insure safe school environment

3.7 ROADS AND PAVED AREAS:

A. The Site Contractor shall construct and maintain temporary areas adequate to support loads and to withstand exposure to traffic during construction period.

1. Includes access for delivery through staging area to building work areas, and to equipment and storage areas and sheds. Maintenance of existing staging area to prevent / repair any ruts by grading with heavy equipment and placement of import ¾” stone for smooth, stable surface.

2. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

3. Temporary areas are installed and/or maintained by for access to all required areas of the sites.

4. Contractors will be permitted to utilize existing campus roads, as designated (as segregated by the Owner - if required).

5. Road Cleaning: Maintain roads and walkways in an acceptably clean condition. This includes the removal of debris daily, if required, and/or a minimum of once a week due to all project traffic. Road cleaning equipment to be wet/vacuum type. The Site Contractor will clean roads for debris from building-related activities.

6. Snow Plowing: The The Site Contractor shall provide snow plowing of temporary road, parking areas, access route, and a 5' walkway to The office trailer.

   a. The school district will provide snow plowing of established routes.

7. Staging Areas:

   a. Temporary parking by construction personnel shall be allowed only in areas so designated.

   b. Owner does not have space for construction parking in existing parking lots or roadways and will subsequently have vehicles in violation of parking prohibitions towed from site and back-charged with all fees to the contractor.

   c. Traffic Regulations:

      a) Access through Owner's entrances shall be limited

      b) Utilize only entrances/temporary roads as designated

      c) Maintain all District traffic regulations

      d) Employee parking to be located as directed by the Construction Manager.

3.8 TRAFFIC CONTROLS

A. Refer to Section 01 5510 - Traffic and Pedestrian Access & Control.

3.9 TEMPORARY SITE SAFETY AND DIRECTIONAL SIGNS:

A. Refer to Section 01 5813 - Temporary Project Signage.

3.10 ENVIRONMENTAL PROTECTION:

A. For interior work within the buildings General Construction Contractor shall provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near Project site.

   1. Site contractor shall meet these provisions as stated above for work outside the building.

3.11 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. At the completion of the project, including all punch list item and prior to Substantial Completion, remove all temporary facilities with the approval of the Construction Manager

SECTION 01 5500
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Access roads.

B. Temporary roads and/or paving.

C. Parking.

D. Existing pavements and parking areas.

E. Permanent pavements and parking facilities.

F. Construction parking controls.

G. Maintenance.

H. Removal, repair.

I. Mud from site vehicles.

1.3 RELATED REQUIREMENTS

A. Section 01 1000 - Summary of Contracts: For access to site and occupancy.

B. Section 01 5000 - Temporary Facilities and Controls.

C. Section 01 5813 - Temporary Project Signage: Post Mounted and/or Wall Mounted Traffic Control and Informational Signs.

D. Section 01 7000 - Execution.

E. Divisions 31, 32 and 33.

1.4 INGRESS AND EGRESS

A. Each Contractor shall provide and maintain at all times safe and adequate ingress and egress to and from site at existing or at new access points consistent with work, unless otherwise authorized by the Construction Manager.

B. However, where major non-conformance with the requirements of this specification is noted by the Construction Manager and prompt contractor compliance is deemed not to be obtainable, all contract work may be stopped by direct order of the Construction Manager regardless of whether corrections are made by the Construction Manager as stated in the paragraph above.

PART 2 PRODUCTS

2.1 RESPONSIBILITY

A. It is specifically noted that if school is in session, there are children playing at recess, walking to outdoor gym classes, etc. Contractor's trucks must be walked from the project site to the main traffic loop and vice versa, with a separate monitoring individual to insure children's safety. See Section 01 1000 - Summary of Contracts for delivery black out times.

B. Contract #5 The Site Contractor is responsibility for the requirements of this section for all Contracts**.**

2.2 MATERIALS

A. Temporary Construction: Refer to Section 01 5000 - Temporary Facilities and Controls.

B. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

2.3 SIGNS, SIGNALS, AND DEVICES

A. Traffic Cones and Drums, Flares and/or Lights: As approved by Construction Manager.

B. Flag Person Equipment: As required by Construction Manager.

PART 3 EXECUTION

3.1 ACCESS ROADS

A. Use of existing on-site streets and driveways for construction traffic is permitted as approved Construction Manager.

B. Tracked vehicles not allowed on paved areas.

C. Contract #5 Site Contractor shall construct and maintain temporary areas adequate to support loads and to withstand exposure to traffic during construction period.

1. Includes access for delivery through staging area to building work areas, and to equipment and storage areas and sheds. Maintenance of staging area to prevent / repair any ruts by grading with heavy equipment and placement of import ¾" stone for smooth, stable surface.

2. Provide dust-control treatment that is nonpolluting and contracting. Reapply treatment as required to minimize dust.

3. Temporary areas are installed and/or maintained for access to all required areas of the sites.

4. Road Cleaning: Maintain roads and walkways in an acceptably clean condition. This includes the removal of debris daily, if required, and/or a minimum of once a week due to all project traffic. Road cleaning equipment to be wet/vacuum type. The General Work Contractor (Contract #1) will clean roads for debris from building-related activities.

5. Snow Plowing: The Site Contractor shall provide snow plowing of temporary road, parking areas, access route, and a 5' walkway to office trailer. Provide snow removal and salting of walkways to office trailer(s). The school district will provide snow plowing of established routes.

D. Construct new temporary all-weather access roads from public thoroughfares to serve construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.

E. Staging Areas:

1. Refer to Section 01 5000 - Temporary Facilities and Controls for additional requirements.

2. Staging areas where indicated on drawings will be provided by Contract #1 General Construction and shall consist of the following:

a. Typed 4 Crushed stone base and conform to the requirements of Section 304 of NYS DOT Specifications. No recycled material of any kind is allowed on the project.

b. Gradation shall conform to the following:

Sieve Size	Percent Passing by Weight
3 inch:	100
2 inch:	90-100
1/4 inch	30-65
No. 40	5-40
No. 200	0-10

F. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.

G. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.

H. Provide and maintain access to fire hydrants and emergency vehicles free of obstructions.

3.2 PARKING

A. Use of designated areas of existing parking facilities by construction personnel is permitted if approved by the Construction Manager.

3.3 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Prior to Substantial Completion the base for permanent roads and parking areas may be used for construction traffic.

B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.4 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Edgemont Union Free School District's operations.

B. Each Contractor shall monitor parking of their personnel's vehicles . Maintain vehicular access to and through thru roads and parking areas as designated and approved by the Construction Manager.

C. Traffic Regulations:

1. Utilize only entrances/temporary roads as designated.

2. Maintain all District traffic regulations.

3. Construction Employee parking to be located as where directed by the Construction Manager.

3.5 FLAG PERSONS

A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes when directed by the Construction Manager.

3.6 HAUL ROUTES

A. Confine construction traffic to designated haul routes as directed by the Construction Manager.

B. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.7 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

3.8 MAINTENANCE

A. Site Contractor shall maintain traffic for the duration of the contract and protect the traveling public and pedestrians from all damage to persons and property within the limits of and for the duration of the contract; all in accordance with the plans and specifications.

B. Site Contractor shall maintain and protect traffic by so conducting his construction operations that the traveling public and pedestrian safety is subjected to a minimum of hazard and delay. In order to adequately maintain and protect traffic, contractor shall perform the following additional minimum requirements as directed by Construction Manager:

1. Keep the surface of the traveled way free from mounds, depressions, and dirt, debris, stone, obstructions of any type which could present hazards or annoyance to traffic.

2. Keep the surface of all pavements used by the public free and clean of all dirt, debris, stone, timber or other obstructions to provide safe traveled ways.

3. Control dust and keep the traveled way free from materials spilled from hauling and construction equipment.

4. Provide all cones, barricades, signs and warning devices as may be required and/or as ordered by the Construction Manager to safely carry out the foregoing. All such signs and devices shall be fabricated and placed in accordance with the latest "Federal Manual on Uniform Control Devices". Use of Open Flares Is Prohibited.

5. Prepare and submit for approval sketch/drawing showing proposed location and type of signs, barricades and devices as required in above.

6. Site Contractor shall cover with steel plates all open trenches at the close of each work day. Such plates to abut each other and be wedged at each end of trench to prevent plates from sliding open.

7. Site Contractor to post temporary construction signs, including construction traffic signs, safety signs, security signs, and no trespassing signs as required.

C. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.9 REMOVAL, REPAIRING INRESS AND EGRESS

A. Remove temporary roads when permanent paving is usable and approved by Construction Manager

B. Remove underground work and compacted materials to a depth of 2 feet; fill and grade site as specified.

C. Repair existing facilities damaged by use, to original condition.

D. Remove equipment and devices when no longer required.

E. Remove post settings to a depth of 2 feet.

3.10 MUD FROM SITE VEHICLES

A. Provide means of removing mud from vehicle wheels before entering streets. See drawings for detailing.

SECTION 01 5713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Scope:
   1. This section covers work necessary for stabilization of soil to prevent erosion during and after construction and land-disturbing activities.
   2. The Work shall include the furnishing of all labor, material, tools, and equipment to perform the Work and services necessary as herein specified and as indicated on the Drawings.
   3. This shall include installation, maintenance, and final removal of all temporary soil erosion and sediment control measures.

B. The minimum areas requiring soil erosion and sediment control measures are indicated on the Drawings.

C. The Owner or Engineer reserves the right to modify the use, location, and quantities of soil erosion and sediment control, based on the Contractor's activities.

D. See additional information noted on the Drawings.

1.2 GENERAL

A. Refer to General Conditions and Division 01, General Requirements, which contain information and requirements that apply to the Work specified herein and are mandatory requirements of for this Project.

B. All activities shall conform to the latest edition of the New York State Storm Water Management Design Manual, the site-specific Storm Water Pollution Prevention Plan (SWPPP), the SPDES General Permit GP-0-25-001, the New York State Standards for Erosion and Sediment Control (Blue Book), and the Drawings. In the event of conflicting requirements, the more stringent requirements shall apply.

C. Soil erosion stabilization and sedimentation control consist of the following elements:
   1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
   2. Construction of new permanent and temporary storm drainage piping and channel systems, as necessary.

3. Construction of temporary erosion control facilities such as silt fences, check dams, etc.
4. Topsoil and seeding:
   a. Placement and maintenance of Temporary Seeding on all areas disturbed by construction.
   b. Placement of permanent topsoil, fertilizer, and seed, etc. in all areas not occupied by structures or pavement, unless shown otherwise.
5. Soil Stabilization Seeding: Placement of fertilizer, seed, etc. in areas as specified hereinafter.

D. The Contractor shall be responsible for phasing and coordinating Work in areas allocated for respective use including proposed stockpile areas to restrict sediment transport. This will include installation of all temporary erosion and sediment control devices, ditches, or other facilities.

E. The areas set aside for the Contractor's use during the Project may be temporarily developed to provide satisfactory working, staging, and administrative areas for its exclusive use. Preparation of these areas shall be in accordance with other requirements contained within these Specifications and shall be done in a manner to control all sediment transport away from the area.

F. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond the immediate stockpile area by installation of silt fence or fiber rolls and construction of temporary toe-of-slope ditches, as necessary. The Contractor shall keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance. Stockpiles remaining in place longer than 14 calendar days shall be considered permanent stockpiles for purposes of erosion and sediment control.

G. All permanent stockpiles shall be seeded with soil stabilization seed and protected by permanent 2-foot-minimum ditches, completely surrounding stockpiles and located within 10 feet of the toes of stockpile slopes.

H. The Contractor shall maintain all elements of the soil erosion and sediment control systems and facilities to be constructed during this Project for the duration of activity on the Project. Formal inspections made jointly by the Contractor and the Engineer shall be conducted every 2 weeks to evaluate the Contractor's conformance. These inspections shall be in addition to the daily inspections performed by the Contractor and the weekly inspections performed by the Engineer.

I. All silt traps shall be cleaned of collected sediment after every storm or as determined from weekly inspections. Cleaning shall be done in a manner that

will not direct the sediment into the storm drain piping system. Removed sediment shall be taken to an area selected by the Engineer where it can be cleaned of sticks and debris, then allowed to dry. Final sediment and debris disposal shall be on-site, as directed by the Engineer.

J. Replacement or repair of failed or overloaded silt fences, check dams, or other temporary erosion control devices shall be accomplished by the Contractor within 2 days after receiving written notice from the Engineer.

K. Unpaved earth drainage ditches shall be re-graded as needed to maintain original grade and remove sediment buildup. If a ditch becomes difficult to maintain, the Contractor shall cooperate with the Engineer and install additional erosion control devices such as check dams, rolled erosion control product, or silt fences, as directed by the Engineer.

L. If the Contractor has not complied with any of the above maintenance efforts to the satisfaction of the Engineer within 2 working days after receiving written notification, the Owner shall have sufficient cause to engage others to perform any needed maintenance or cleanup, including removal of accumulated sediment at constructed erosion control facilities, and deduct from the Contractor's monthly partial payment the costs for such efforts, plus a $500 administrative fee.

1.3 SUBMITTALS

A. In addition, the Contractor shall provide the following specific information:
   1. Certificates of inspection of seed by State or Federal authorities and copies of delivery invoices or other proof of quantities of fertilizer.
   2. Manufacturer's certificate of compliance attesting that the geotextile meets the requirements of these Specifications.
   3. Product data in the form of manufacturer's technical data, specifications, and installation instructions for rolled erosion control product and accessories.

PART 2 PRODUCTS

2.1 PERMANENT SEED

A. Refer to Section 32 9200 Turf and Grasses for Permanent Seed Mixes.

2.2 SOIL STABILIZATION AND TEMPORARY SEED

A. Summer seed mix shall be Annual or Perennial Ryegrass.

B. Winter seed mix shall be Certified Aroostook Winter Rye (cereal rye).

2.3 TOPSOIL

A. Topsoil shall be as specified under Section 31 2323 – Fill and Section 32 9200, Turf and Grasses.

2.4 FERTILIZER

A. Fertilizer shall be commercial, chemical type, uniform in composition, free-flowing, conforming to State and Federal laws, and suitable for application with equipment designed for that purpose.

B. State law prohibits the application of fertilizer between December 1 and April 1, and application within 20 feet of a surface water is restricted.

C. Fertilizers shall have a minimum percentage of plant food by weight for the following: Permanent fertilizer mix shall be 3 percent nitrogen, 0 percent phosphoric acid, and 2 percent potash.

D. Fertilizer with phosphate composition greater than 0.67 percent by weight may only be used if new lawn is being established or a soil test indicates that it is necessary.

2.5 LIME

A. Provide in accordance with Section 32 9200 Turfs and Grasses.

B. Quantity of lime needed varies by soil pH. Apply in accordance with current edition of the New York State Standards and Specifications for Erosion and Sediment Control.

2.6 STRAW MULCH

A. Threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds, or clean salt hay applied at 2 tons per acre.

2.7 ROLLED EROSION CONTROL PRODUCT

A. The rolled erosion control product (RECP) shall be biodegradable and comprised of jute mesh.

B. The RECP shall be of consistent thickness.

C. The RECP shall be the Class and Type as specified on the Contract Drawings.

D. RECP shall be a product by a manufacturer listed on the NYSDOT Approved Materials List.

E. The functional longevity of the RECP shall be approximately 24 months.

F. All RECP shall be properly stored by the Contractor at the site per manufacturer's recommendations.

G. RECP damaged during storage shall be replaced at the Contractor's expense.

PART 3 EXECUTION

3.1 GENERAL

A. Install erosion and sediment control measures and maintain in accordance with the Drawings, General Permit, and the SWPPP.

B. Provide and maintain Temporary Seeding at all times.

3.2 SEEDING

A. General:
1. The Contractor shall give at least 3 days' notice to the Engineer prior to seeding to allow the Owner to inspect the prepared areas. The Contractor shall rework all areas not approved for seeding to the Owner's satisfaction.
2. The Contractor shall keep the Engineer advised of schedule of operations.
3. Seed shall be clean, delivered in original, unopened packages and bearing an analysis of the contents, guaranteed 95 percent pure with minimum germination rate of 85 percent.

B. Schedules:
1. Seeding shall be performed in accordance with the following schedule:
   a. Summer Seeding: From March 15 to June 15, and September 1 to October 15.
   b. Winter Seeding: All other times of year, except when weather conditions prohibit further construction operations as determined by the Engineer.

C. Soil Stabilization and Temporary Seeding:
1. Soil stabilization seeding shall consist of the application of the following materials in quantities as further described herein for stockpiles and disturbed areas left inactive for more than 14 days:
   a. Lime (permanent seeding only).
   b. Fertilizer (permanent seeding only).
   c. Temporary seed mix at 30 pounds per acre for summer seed mix or 100 pounds per acre for winter seed mix.

d. Mulch.
e. Maintenance.

2. Hydroseeding will be permitted as an alternative method of applying seed and associated soil conditioning agents described above. Submit hydroseeding application plan and methods prior to commencing work.
3. Temporary Seeding shall be placed and maintained over all disturbed areas prior to Permanent Seeding. Maintain Temporary Seeding until such time as areas are approved for Permanent Seeding. As a minimum, maintenance shall include:
   a. Repair and re-seeding bare areas or re-disturbed areas.
   b. Mowing for stands of grass or weeds exceeding 6 inches in height.

3.3 ROLLED EROSION CONTROL PRODUCT

A. Install RECP on slopes with gradient 3:1 or steeper.

B. Prepare soil before installing RECP, including any necessary application of lime, fertilizer, and seed. Ground surface shall be free of debris, rocks, and raked smooth to allow direct contact of the RECP with the soil over the entirely of the installation.

C. Spread RECP over prepared soil starting from the top of slope. Anchor each blanket in 6 inches deep and 6 inches wide trench, with 12 inches of blanket extended beyond trench up-slope to be folded over the filled trench. Anchor blanket in trench with a row of stakes spaced 12 inches apart. Backfill trench and compact fill material. Apply seed to compacted soil. Fold blanket over compacted soil and secure it with a row of stakes spaced 12 inches apart.

D. Roll RECP down or horizontally across the slope. Fasten blanket to soil surface by placing stakes at locations indicated or recommended by manufacturer. Overlap parallel blankets 2 inches to 5 inches, or as recommended by manufacturer. Overlap consecutive blankets spliced down the slope 3 inches “shingle style”, end over end. Stake through overlapped areas 12 inches apart across entire blanket width.

3.4 SUPPLEMENT

A. The supplements listed below and provided separately are part of this specification:
   1. Stormwater Pollution Prevention Plan for the Greenville Elementary School Interior Renovations and Site Work Project.

++END OF SECTION++

SECTION 01 5728
TEMPORARY SANITARY SEWER FLOW CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. These minimum requirements shall be applied where shown and specified within the Contract Documents and where required by the Contractor's means, methods, and sequences to ensure adequate maintenance of sanitary sewer flow during the course of the Work.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this Section:
   1. ASTM International (ASTM):
      a. D3350, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
   2. American Water Works Association (AWWA):
      a. C110/A21.20, ANSI Standard for Ductile Iron and Gray Iron Fittings, 3 in. – 48 in. for Water.
      b. C111/A21.11, ANSI Standard for Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
      c. C151/A21.51, ANSI Standard for Ductile Iron Pipe, Centrifugally Cast, for Water.

B. Related work specified elsewhere:
   1. Section 33 0561, Concrete Manholes

1.3 DEFINITIONS

A. Flow control: Procedure and method to reduce or eliminate flow in a downstream sewer to a level adequate for proper work on sewers, as shown and specified in the Contract Documents.

B. Temporary Bypass Pumping: Flow control method that uses a temporary bypass pumping system.

1.4 PERFORMANCE REQUIREMENTS

A. It is essential to operation of the existing sewerage system that there be no interruption of flow of sewage throughout the duration of the Project.

B. Provide, maintain, and operate temporary facilities such as dams, plugs, pumping equipment, conduits, and necessary power to intercept sewage flow before it reaches a point where it would interfere with the Work.

C. Maintain sewer flow around the Work area in a manner that will not cause surcharging or damage to sewers and that will protect public and private property from damage.

D. Protect water resources, wetlands, wells, and other natural resources.

1.5 SUBMITTALS

A. Informational submittals:
   1. Flow control plan: Submit at least two weeks prior to assuming control of the sewer flows. As a minimum, include the following:
      a. Estimate of peak amount of flow to be controlled.
      b. Detailed procedures for handling peak estimated flow.
      c. Schedule.
      d. Equipment cut sheets and product information of proposed equipment, including plugs, test balls, and pumping equipment.
      e. List of equipment:
         1) Bypass pump sizes, capacities, number of each size to be onsite, and power requirements including standby equipment.
         2) Bypass pipeline sizes and material types.
      f. Sewer user notification plan.
      g. Operation plan and staffing plan.
      h. Emergency procedures.
   2. Permits to locate and operate the flow control system.

1.6 SEQUENCING AND SCHEDULING

A. Work on sewers shall not be performed during rain events, snow melt events, or when flow in a sewer is otherwise high.

PART 2 PRODUCTS

2.1 FLOW CONTROL SYSTEM

A. General: Provide adequate capacity and size to handle existing flows plus additional flows that may occur during periods of rainstorm.

B. Estimate peak amount of flow to be bypassed and provide bypass flow capacity of at least 125 percent of the peak flow estimate.

C. Plugs:

1. Provide with taps for connection of pressure gauges and air hoses, and flow-through capability.
2. Pipe diameters 24 inches and smaller: use mechanical plugs with rubber gaskets or pneumatic plugs with rubber boots.
3. Pipe diameters larger than 24 inches:
   a. Use inflatable bag stoppers made in two or more pieces.
   b. Manufacturer: Lansas, Cherne Industries.

D. High-density polyethylene (HDPE) or ductile iron discharge piping:
1. Leak-free.
2. Pressure-rating at least 1.5 times the operating pressure.
3. HDPE pressure piping:
   a. In accordance with ASTM D3350.
   b. SDR of 32.5, maximum.
   c. Joints: butt fusion welded.
4. Reuse of used piping materials:
   a. Piping need not be new, but shall be clean and in a serviceable condition.
   b. Pipe materials may be reused for subsequent flow bypass placements.
   c. The Owner or the Engineer reserve the right to reject sections of pipe deemed unserviceable.

E. Bypass Pumps:
1. Pumps shall be fully-automatic, self-priming units that do not require use of foot valves or vacuum pumps in the priming system.
2. Impellers shall be an open impeller design with the ability to pump a minimum 3-inch diameter solid without clogging.
3. Pumps shall be able to run dry for long periods of time to accommodate cyclical nature of flows.
4. Engine-driven pumps shall be equipped with noise attenuators. Noise levels shall not exceed 86 dB(A) at a distance of 50 feet from the source.
5. Standby pump: One of each size shall be available onsite while sewers are being bypassed.

PART 3 EXECUTION

3.1 GENERAL

A. Notify the Engineer at least 48 hours prior to implementing flow control systems.

B. Operate and maintain 24 hours per day, 7 days per week, including holidays, as required to control flow.

C. Take all necessary precautions to ensure no private or public properties are subjected to a sewage backup or spill. The Contractor shall be solely responsible for all cleanup, damages, and resultant fines in the event of a backup or spill.

D. Eliminate flow from sewer manhole-to-manhole segments during service connection rehabilitation within that segment.

E. If flow reaches peak estimated flow for which the bypass system was designed, stop all Work that requires flow control, secure work area, and restore flow in the sewer until the flow recedes.

F. After the Work is completed, return flow to the completed work and remove temporary equipment.

3.2 BLOCKING FLOW

A. Flow control may consist of blocking flow with mechanical or pneumatic plugs if only a small amount of flow needs to be controlled, the Work is of short duration, and adequate storage is available in the line.

B. Use primary and secondary plugs for each flow control location.

C. When blocking flow is no longer needed for performance and acceptance of the Work, remove plugs in a manner that permits sewage flow to slowly return to normal without surcharging or causing other major disturbances downstream.

D. Remove temporary plugs at the end of each working day and restore normal flow. If downstream Work is not or cannot be completed during the workday, then provide, operate, and maintain a bypass pumping system as specified herein.

E. Use bypass pumping if the Work cannot be scheduled at a time when flow is low or completed during low flow period.

3.3 BYPASS PUMPING

A. When blocking flow in upstream sewers is not appropriate, use flow bypass pumping for reducing flow below the maximum depth or for complete bypassing of flow.

B. Design, furnish, install, and maintain all power, primary and standby pumps, appurtenances, tanks and trucks, and bypass piping required to maintain existing flows and services.

C. Obtain approval and secure all permits for placement or temporary bypass pumping system and pipeline within public right-of-way.

D. Site verification:
   1. Locate existing utilities in area of bypass pipelines.
   2. Bypass pipeline location:
      a. Minimize disturbance of existing utilities.
      b. Confine bypass discharge pipeline within public rights-of-way or temporary construction area and permanent easement.
      c. When bypass pipeline crosses local streets and private driveways, place bypass pipeline in trench and cover with temporary pavement.
      d. Installation of bypass pipelines is prohibited in designated wetlands.

E. Flow bypass shall be done in such a manner that will not damage private or public property, or create a nuisance or public menace. Pumped sewage shall be in an enclosed pipe that is adequately protected from traffic, and shall be redirected into the sanitary sewer system or alternatively into an enclosed tank for hauling to the wastewater treatment plant. Dumping or free flow of sewage on private or public property, gutters, streets, sidewalks, or into storm sewers is prohibited.

3.4 FIELD QUALITY CONTROL

A. Hydrostatic pressure test for pump bypass system:
   1. Prior to operation, test each section of discharge piping with maximum pressure equal to 1.5 times the maximum operating pressure of the system.
   2. Notify the Engineer 24 hours prior to testing.

3.5 CLEANING

A. Before the bypass pumping system is broken down and moved to the next section or removed at the completion of the Work, discharge sewage remaining in the bypass discharge pipeline and pumping equipment into the sanitary sewer.

B. Disturbed areas: Upon completion of bypass pumping operation, clean disturbed areas, restoring to condition, including pavement restoration, at least equal to that which existed prior to the start of the Work.

++END OF SECTION++

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SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

C. All Contractors, Subcontractors, Sub-subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.3 RELATED REQUIREMENTS

A. Section 01 1000 - Summary of Contracts.

B. Section 01 5000 - Temporary Facilities and Controls.

C. Section 10 1400 - Signage for permanent signs.

1.4 REFERENCE STANDARDS

A. New York State Department of Transportation.

1.5 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr wind velocity.

B. Sign Painter: Experienced as a professional sign painter for minimum three years.

C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, structure, sizes.

PART 2 PRODUCTS

2.1 RESPONSIBILITY

A. Site Contractor is responsible for the requirements of this section for all contracts.

2.2 TRAFFIC SIGN MATERIALS

A. Structure and Framing: New or Used metal or wood, structurally adequate.

B. Metal Signs shall be minimum 16 gauge steel.

C. Size shall be appropriate to message and in conformance to State of NY DOT.

D. Rough Hardware: Galvanized or aluminum.

E. Paint and Primers: Exterior quality, two coats; sign background of color as selected.

F. Lettering: Exterior quality paint, white.

2.3 PROJECT IDENTIFICATION SIGN

A. Project Identification Sign shall be the responsibility of Site Contractor

B. One painted sign, 48 sq ft area, bottom 6 feet above ground.

C. Content:

1. Project number, title, logo and name of Edgemont Union Free School District as indicated on Contract Documents.

2. Names and titles of authorities.

3. Names and titles of and Consultants. Owner's Representative, Architect, Construction Manager, and Consultants

4. Name of Prime Contractors .

D. Graphic Design, Colors, Style of Lettering: Designated by Architect.

2.4 PROJECT INFORMATIONAL SIGNS

A. Painted informational signs of same colors and lettering as Project Identification sign, or color as selected of standard products; size lettering to provide legibility at 100 foot distance.

B. Each Contractor shall provide identification signage at field office and storage trailers with contractor's name and telephone number.

C. Site Contractor shall provide directional signs to direct traffic into and within site. Relocate as Work progress requires.

2.5 TEMPORARY SITE SAFETY AND DIRECTIONAL SIGNS:

A. Prepare temporary signs to provide directional information to construction personnel and visitors.

B. Construct signs of exterior type Grade AC plywood ½" thick. Support on posts or framing of preservative-treated wood or steel, or attach to fencing; do not attach signs to buildings or permanent construction.

C. Paint sign panel and applied graphics with exterior grade alkyd gloss enamel over exterior primer. Engage an experienced sign painter or fabricator to apply graphics.

D. Include relocating temporary site safety and directional signs as many times as required or directed.

E. Metal DOT / MUTCO compliant signage is acceptable where applicable.

F. Site Contractor shall furnish and install construction signage as required at each project site.

1. For construction traffic control/flow at entrances/exits, as designated by the Construction Manager (8 required).

2. To direct visitors (4 required)

3. For construction parking (4 required)

4. To direct deliveries (4 required)

5. Emergency egress only - Construction area (8 required)

6. Per OSHA standards as necessary.

7. For “No Smoking” safe work site at multiple locations (6 required).

2.6 SIGNS, SIGNALS, AND DEVICES (Contractor's Option)

A. Stock Post Mounted and Wall Mounted Traffic Control and Informational Signs:

1. Products:

a. Brimar Industries, Inc.: www.safetysign.com/#sle.

b. Substitutions: Section 01 2500 Substitution Procedures.

PART 3 EXECUTION

3.1 INSTALLATION

A. Erect at location of high public visibility adjacent to main entrance to site and as directed by Construction Manager.

B. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

C. Install sign surface plumb and level, with butt joints. Anchor securely.

D. Paint exposed surfaces of sign, supports, and framing.

3.2 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.3 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of the project and restore the area.

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Maintenance materials, extra materials.

1.3 RELATED REQUIREMENTS

A. Section 01 2500 - Substitution Procedures:

B. Section 01 4000 - Quality Requirements: Product quality monitoring.

C. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.4 REFERENCE STANDARDS

NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5 DEFINITIONS

A. Refer to General Conditions and Section 01 4216 - Definitions for additional definitions.

B. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

C. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.

D. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

E. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

F. Substitutions: Changes in products, materials, equipment, and methods of construction from those required or specified by the Contract Documents and proposed by Contractor.

G. Basis-of-Design Or Equal Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," or "or equal", including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers **shall be submitted as substitutions**.

1. Refer to Section 01 2500 - Substitution Procedures.

H. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

1.6 SUBMITTALS

A. Refer to Section 01 3000 - Administrative Requirements for additional requirements

B. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 30 days after date of Notice of Award.

2. For products specified only by reference standards, list applicable reference standards.

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.7 QUALITY ASSURANCE

A. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

1.8 ASBESTOS

A. Asbestos: All products, materials, etc., used in conjunction with this Project shall be Asbestos-Free.

1. Each Contractor shall provide a certified letter to the Construction Manager stating that no asbestos containing material has been used in this project. Refer to Section 01 7800 - Closeout Submittals.

B. Each, Contractor, and sub contractors must provide test results upon completion from a New York State accredited testing lab certifying that all material including joint and pipe insulation on this project is non-asbestos.

1. This certification shall be based on a sampling of 10% of all linear feet of pipe insulation, (unless manufacturer's certificate is submitted).

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Edgemont Union Free School District, or otherwise indicated as to remain the property of the Edgemont Union Free School District, become the property of the Contractor(s); remove from site.

2.2 NEW PRODUCTS

A. Provide new products for all unless otherwise specifically required or permitted by the Contract Documents.

B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:

1. Made outside the United States, its territories, Canada, or Mexico.

2. Made using or containing CFC's or HCFC's.

3. Made of wood from newly cut old growth timber.

4. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, each Contractor shall give preference to products that:

1. If used on interior, have lower emissions, as defined in Section 01 6116.

2. If wet-applied, have lower VOC content, as defined in Section 01 6116.

3. Are extracted, harvested, and/or manufactured closer to the location of the project.

4. Have longer documented life span under normal use.

5. Result in less construction waste. See Section 01 7419

6. Are made of vegetable materials that are rapidly renewable.

7. Are made of recycled materials.

8. Are Cradle-to-Cradle Certified.

9. Have a published Environmental Product Declaration (EPD).

10. Have a published Health Product Declaration (HPD).

2.3 PRODUCT OPTIONS

A. Refer to Section 00 2113 - Instructions to Bidders for Product/Assembly/System Substitutions.

B. Refer to Section 01 2500 - Substitution Procedures.

2.4 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

1. Deliver to Construction Manager; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION SUBMITTAL PROCEDURE AFTER BIDDING PHASE

A. Refer to Section 01 2500 - Substitution Procedures.

3.2 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.3 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

1. Execute a formal supplemental agreement between Edgemont Union Free School District and Contractor allowing off-site storage, for each occurrence.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions.

I. Do not store products directly on the ground.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

C. Requirement for installer certification that they did not use any non-compliant products.

1.3 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, delivery, storage, and handling.

D. Section 07 9200 - Joint Sealants: Emissions-compliant sealants.

E. Section 09 5100 - Acoustical Ceilings.

F. Section 09 9123 - Interior Painting.

G. Section 09 6500 - Resilient Flooring.

1.4 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.

2. Interior adhesives and sealants applied on site, including flooring adhesives.

3. Flooring.

4. Products making up wall and ceiling assemblies.

5. Thermal and acoustical insulation.

6. Free-standing furniture.

7. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.

2. Interior adhesives and sealants applied on site, including flooring adhesives.

3. Wet-applied roofing and waterproofing.

4. Other products when specifically stated in the specifications.

C. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:

1. Interior of Building: Anywhere inside the exterior weather barrier.

2. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

3. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

D. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:

1. Concrete.

2. Clay brick.

3. Metals that are plated, anodized, or powder-coated.

4. Glass.

5. Ceramics.

6. Solid wood flooring that is unfinished and untreated.

1.5 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.

D. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

E. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.

F. GreenSeal GS-36 - Adhesives for Commercial Use; 2013.

G. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).

H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Evidence of Compliance: Submit for each different product in each applicable category.

C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

D. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.7 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.

1. Wet-Applied Products: State amount applied in mass per surface area.

2. Paints and Coatings: Test tinted products, not just tinting bases.

3. Evidence of Compliance: Acceptable types of evidence are the following;

a. Current UL (GGG) certification.

b. Current SCS (CPD) Floorscore certification.

c. Current SCS (CPD) Indoor Advantage Gold certification.

d. Current listing in CHPS (HPPD) as a low-emitting product.

e. Current CRI (GLP) certification.

f. Test report showing compliance and stating exposure scenario used.

4. Product data submittal showing VOC content is NOT acceptable evidence.

5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Report of laboratory testing performed in accordance with requirements.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.1 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. VOC-Content-Restricted Products: VOC content not greater than required by the following:

1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.

2. Aerosol Adhesives: GreenSeal GS-36.

3. Joint Sealants: SCAQMD 1168 Rule.

4. Paints and Coatings: Each color; most stringent of the following:

a. 40 CFR 59, Subpart D.

b. SCAQMD 1113 Rule.

c. CARB (SCM).

5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Edgemont Union Free School District reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Edgemont Union Free School District.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by the Contractor.

SECTION 01 6190
MATRIX OF BUILDING SYSTEM RESPONSIBILITY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. This section describes the relationship and responsibilities of the Prime Contractors, suppliers, vendors,, subcontractors and Owner.

1.3 RELATED REQUIREMENTS

A. Section 01 1000 - Summary of Contracts: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 01 2000 - Price and Payment Procedures: Applications for payment, Schedule of Values, modifications procedures, closeout procedures.

C. Section 01 2100 - Allowances: Cash and contingency allowances.

D. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

E. Section 01 7419 - Construction Waste Management and Disposal.

F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

G. Section 01 7900 - Demonstration and Training: Detailed requirements.

H. Section 01 9113 - General Commissioning Requirements.

1.4 PRICE AND PAYMENT PROCEDURES

A. Allowances: See Section 01 2100 - Allowances, for cash allowances affecting this section.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.1 MATRIX

A. See attached.

3.2 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.3 COMMISSIONING

A. See Section 01 9113 - General Commissioning Requirements, for commissioning requirements.

B. Perform the following Functional Tests:

3.4 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.5 RESPONSIBILITY

A. It is the Contactors responsibility to coordinate and obtain from the Owner all information neccessary to complete the work.

3.6 ATTACHMENTS

A. Matrix is attached to this section.

Edgemont Seely & Greenville Matrix of Building System Responsibility

Work Description	Furnished By	Installed By	Comments/Response
DATA			
Rough-in: Conduit drops in walls, wired to outlet, conduit (unfinished area), conduit sleeve, junction box (wall and/or ceiling type), outlet box, floor box, poke-thru, cover plate with female bulk head, supports.	EC	EC	
In wall combo boxes, cover plate, bulkheads (Jacks) for Data/Tele	EC	EC	
Data Cat 6 Cable Support - J-Hooks, fire rated zip ties and ladders in data closet.	EC	EC	
Data Cat 6 Cable - From Data Outlet & WAP to Patch Panel. Tag both ends of cable, type written address nomenclature at outlet and patch panel, Test cable as per Spec.	EC	EC	All Addresses will be furnished by ESD
Data cable color selection.	N/A	N/A	BLUE Data Cables
New Data rack/closets: new racks, ladders, patch panels and all patch cords. See specs for quantity and color.	EC	EC	Separate patch panel for each wire category
Fiber Cable - From IDF to MDF, including connectors, connection (termination), labelling and testing , OM3 (12 Strand 10 Gigabyte) 50um Fiber Cable - Specific cable type description shall be provided by ESD)	ESD	ESD	
Device Address to be furnished by ESD to Electrical Contractor - EC to provide labels	ESD	EC	
Wireless Access Point Device (WAP) and configuration.	ESD	ESD	YELLOW Data Cables
Switches, servers, Relays UPS onto racks including installing patch cords from patch panel to switches. Patch Cords furnished by EC as indicated above.	ESD	ESD	
Provide PC's, Lap Tops, I-Pads, Chrome Carts	ESD	ESD	
Interface with District Network including and not limited to Programming, Integration, Commissioning of Hardware and Software. Include all licenses.	ESD	EDS	
Patch and Paint disturbed areas in Existing Building	EC	EC	

Edgemont Seely & Greenville: Matrix of Building System Responsibility

Work Description	Furnished By	Installed By	Comments/Response
Patch and Paint at newly constructed areas	GC	GC	
Plywood mounting boards for equipment panels, etc..	EC	EC	
Telephone			
Rough-in: Conduit drops in walls, wiremold, conduit, conduit sleeve, junction box, outlet box, floor box, poke-thru, cover plate with female bulk head, mini PBX, supports.	EC	EC	
Telephone Cat 6 Cable Support - J-Hooks, fire rated zip ties.	EC	EC	
Telephone Cat 6 Cable - From Telephone Outlet to Patch Panel. Tag both ends of cable, type written address nomenclature at outlet and patch panel, include patch panels, patch cords (Patch cord quantity listed under Data Section). Test cable as per Spec.	EC	EC	
Telephone cable color selection.	ESD	N/A	WHITE Cable Color
Telephone Head-end equipment.	ESD	ESD	
Telephone Hand Set.	ESD	ESD	
Telephone Switches, servers, Relays UPS onto racks including jumper cable from patch panel to switches. Patch Cords furnished by EC as indicated in Data Section above.	ESD	ESD	
Switches or relays to interface with School Copper wire phone system.	ESD	ESD	
Integration and programming of phones.	Current District Vendor	N/A	
Security Cameras			
Rough-in: Conduit drops in new walls, wired to outlet, conduit sleeve, junction box (durable wall and/or ceiling type to support camera), supports.	EC	EC	
Camera Cat 6 Cable, Supports - J-Hooks, fire rated zip ties.	EC	EC	

Edgemont Seely & Greenville: Matrix of Building System Responsibility

Work Description	Furnished By	Installed By	Comments/Response
Camera Cat 6 Cable - From Camera J-Box to Patch Panel. Provide 5'-0" pig tail @ each J- Box. Tag both ends of cable. Include patch panel and patch cords. Test cable as per Spec	EC	EC	
Type written address specialty nomenclature at each Camera and patch panel.	EC	EC	
Camera mounting brackets.	EC	EC	
Camera and other mounting accessories.	Owner Assigned Security Vendor	EC	
Camera Lens Adjustment, Camera Adjustment, sequencing, commissioning, etc.	Owner Assigned Security Vendor	Owner Assigned Security Vendor	
Camera Switch, DVR, Server, Programming, integration, Licenses.	Owner Assigned Security Vendor	Owner Assigned Security Vendor	
Interface and provide conductivity for Cameras to data system.	Owner Assigned Security Vendor	Owner Assigned Security Vendor	
Setup the Cameras to be viewed on Monitors.	Owner Assigned Security Vendor	Owner Assigned Security Vendor	
Door Access (Interior Doors)			
Electronic Door Locksets (including batteries)	GC	GC	
Panel Interface Modules (PIMs)	GC	EC	
Cat 6 Cable from PIMs to patch panel on data rack.	EC	EC	
Programming, Smarts & Parts	Owner Assigned Security Vendor	Owner Assigned Security Vendor	

Edgemont Seely & Greenville: Matrix of Building System Responsibility

Work Description	Furnished By	Installed By	Comments/Response
CAT 6 cable from existing exterior door electric strikes to new I.T. Closet	EC	EC	
Switches, relays, etc.	Owner Assigned Security Vendor	Owner Assigned Security Vendor	
Integration into existing access control head-end controller and data base.	Owner Assigned Security Vendor	Owner Assigned Security Vendor	
Fire Alarm System			
Rough-in: Conduit drops in walls, MC Cable, wiring, wiremold, conduit, conduit sleeve; J-box (wall and/or ceiling type), cover plate, supports.	EC	EC	
Fire Alarm Devices - Horn/Strobe, Speaker/Strobes, Strobes, Manual Pull station, smoke/heat detectors, duct detector, DGP, F.A.C.P. Expansion cards, relays, Annunciator, Carbon detectors, Gas Detectors, etc.	EC	EC	
Magnetic Door Holders.	EC	EC	
The F.A. wiring for Magnetic Door Holders (MH). Include line voltage. Provide high power addressable control relays to interface with MH.	EC	EC	
F.A. Devices address labelling at each device.	EC	EC	
Fire Alarm Floor Layout Plaque.	EC	EC	

Edgemont Seely & Greenville: Matrix of Building System Responsibility

Work Description	Furnished By	Installed By	Comments/Response
Fire Alarm Programming & Start-up	EC	EC	EC to coordinate with owner all room numbers/designation before the start of programming.
P.A. System and Clock			
Rough-in: Wiremold, conduit, conduit sleeve; J-box, outlet box, supports.	EC	EC	
P.A. System Cable Support - J-Hooks, fire rated zip ties.	EC	EC	
New P.A. System Cable - From indicated rooms to IT Closets. Tag both ends of cable, Test cable as per Spec and provide report.	EC	EC	
P.A. System Speaker, Integrated Message/Clock Panel, Call-In Button.	EC	EC	
P.A. System Programming and integration with existing system.	District Assigned Vendor	District Assigned Vendor	
Interface zone modules, switches, relays, etc. for connection to current system.	District Assigned Vendor	District Assigned Vendor	
Integrated Speaker/Clock	EC	EC	
PA Tie-In to incident Command Panel	ESD	ESD	
LIGHTING CONTROLS			
Lighting controls (Complete Installation included and not limited to wiring, conduit, supports, Programming, etc.)	EC	EC	

Edgemont Seely & Greenville: Matrix of Building System Responsibility

Work Description	Furnished By	Installed By	Comments/Response
Commissioning (Third Party)	Owner Third Party Commissioning Agent	Owner Third Party Commissioning Agent	Electrical Contractor shall assist Third Party Commissioning Agent.
Mechanical Equipment Controls			
All low voltage wiring and conduit in unfinished areas, line voltage circuit for mechanical equipment, installation, tie-ins, update programming for heating and Cooling to BMS system.	HVAC Sub Controller Contractor	HVAC Sub Controller Contractor	Refer to Specification Section 23 0000 for additional information.
Commissioning (Third Party)	Owner Third Party Commissioning Agent	Owner Third Party Commissioning Agent	HVAC Sub Controller Contract and HVAC Contractor shall assist Third Party Commissioning Agent.
ESD interfaces with District Network IP Address	HVAC Sub	HVAC Sub	
Network Drops to equipment's	HVAC Sub	HVAC Sub	
Line Voltage Electric power to BMS control panels	HVAC Contr.	HVAC Contr.	

SECTION 01 7000
EXECUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Inspections prior to start of work.

B. Examination, preparation, and general installation procedures.

C. Requirements for alterations work, including selective removals and asbestos/lead abatement.

D. General installation of products.

E. Protection of installed construction.

F. Correction of the Work.

G. Pre-installation meetings.

H. Dust control

I. Cutting and patching.

J. Surveying for laying out the work.

K. Progress and Final cleaning.

L. Protection of installed construction.

M. Starting of systems and equipment.

N. Demonstration and instruction of Edgemont Union Free School District personnel.

O. Closeout procedures, including Contractor's Correction Punch List.

1.3 RELATED REQUIREMENTS

A. Section 01 1000 - Summary of Contracts: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls.

E. Section 01 3553 - Site Safety and Security Procedures

F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties.

G. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

H. Section 01 9113 - General Commissioning Requirements: Contractor's responsibilities in regard to commissioning.

I. Section 01 2100 - Allowances.

J. Section 07 8400 - Firestopping.

K. Section 31 2316 - Excavation.

L. Individual Specification Sections:

1.4 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers and Architect and Construction Manager.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous and non-hazardous materials and hazardous waste disposal.

C. Cutting and Patching:

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.

2. Integrity of weather exposed or moisture resistant element.

3. Efficiency, maintenance, or safety of any operational element.

4. Visual qualities of sight exposed elements.

5. Include in request:

a. Identification of Project.

b. Location and description of affected work.

c. Necessity for cutting or alteration.

d. Effect on work of Edgemont Union Free School District or separate Contractor.

e. Written permission of affected separate Contractor.

f. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.7 QUALIFICATIONS

1.8 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases. Refer to Section 01 5000 - Temporary Facilities and Controls.

F. Dust Control: Each Contractor shall execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

G. Contract #1 General Construction Contractor shall provide dust-proof barriers between construction areas, non construction areas and occupied areas.

1. Refer to Section 01 5000 - Temporary Facilities and Controls.

H. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1. Minimize amount of bare soil exposed at one time.

2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

3. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

I. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. Outdoors: Limit conduct of especially noisy exterior work to hours within the local Noise ordinances.

J. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

1.9 COORDINATION

A. Refer to Section 01 3000 - Administrative Requirements.

1.10 CODES, PERMITS, FEES, ETC.

A. Refer to Section 01 4100 Regulatory Requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 2500 - Substitution Procedures.

2.2 CERTIFIED SURVEYS

A. Survey work shall be the responsibility of Site Contractor

B. Responsibility included all provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.

C. Provision of facilities and assistance necessary for Construction Manager to check lines and grade points placed by Contractor.

D. Certified Surveys:

1. Certified Surveys: Submit two copies along with digital copy signed by land surveyor or professional engineer for each the following surveys:

a. Final Survey: Before substantial completion, the Surveyor shall prepare a final property survey showing significant features (real property) that have resulted from construction of the project, including underground utilities, tanks and similar work install under all contract.

a) Each prime contractor shall provide related information to the surveyor for the work installed under their contract. Include on the survey a certification, signed by the Surveyor, to the effect that the principal lines and levels of the project are accurately positioned as shown on the drawings.

b) Show, where applicable, boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

c) Final Survey: Submit electronic copy on flash drive showing the Work performed and record survey data.

2.3 SITE SCOPING

A. Site Scoping shall be the responsibility of the Contract #5 Site Contractor.

1. Provide scoping near Gas Rig.

B. Call ProTek (718) 472-2304 or info@ProTekLocating.com, before beginning any excavation at least five (5) working days prior to the start of construction, and locate and identify all underground utilities etc.

C. Submit two copies signed by scoping firm indication of all piping locations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify Construction Manager of any discrepancies immediately in writing before proceeding to lay out the work. Locate and protect existing benchmarks and base line. Preserve permanent reference points during construction.

B. Prior to start of construction take photographs, video's or similar documentation as evidence of existing project conditions as follows:

1. Interior views: Each room and areas of outside or within the work area which could be construed as caused by the contractor.

2. Exterior views: Each area of work outside and adjacent to the work area which could be construed as caused by the contractor.

C. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

D. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

E. Examine and verify specific conditions described in individual specification sections.

F. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

G. Verify that utility services are available, of the correct characteristics, and in the correct locations.

H. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Construction Manager five (5) working days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.

2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with one copies to Architect and Construction Manager, participants and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Professional land surveyor shall verify locations of survey control points prior to starting work. Refer to drawings.

B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.

C. General Contractor shall locate and protect survey control and reference points.

D. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Construction Manager.

E. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

F. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations.

G. Construction Surveying:

1. General: Perform surveying as applicable to specific items necessary for proper execution of work.

a. Alignment Staking: Provide alignment stakes at 50 foot intervals on tangent, and at 25 foot intervals on curves.

b. Slope Staking: Provide slope staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. Re-stake at every ten-foot difference in elevation.

c. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.

d. Road: Stake out roadway elevations at 50 foot50-foot intervals on tangent, and at 25 foot intervals on curves.

e. Cross-sections: Provide original, intermediate, and final staking as required, for site work and other locations as necessary for quantity surveys.

f. Record Staking: Provide permanent stake at each blind flange and each utility cap is provided for future connections. Use stakes for record staking of material(s) acceptable to Construction Manager.

3.5 REMOVAL AND DUST CONTROL

A. The following procedures shall be followed when removals are performed:

1. Asbestos and lead containing material shall be removed as per asbestos and lead abatement sections of the specifications.

   a. Refer to Section 02 2080 Asbestos Removal and Disposal.

2. Exterior

   a. Work must be in compliance with OSHA Construction Standard (29 CFR 1926.62).

   b. Provide tarps on the outside of the building to catch all dust, debris and paint chips when items are being removed and installed.

3. Interior:

   a. Floor surfaces protection as specified in Section 01 5000 - Temporary Facilities and Controls.

   b. All air vents in the room shall be closed, shut off and sealed.

   c. Access to all rooms undergoing removals shall be restricted to prevent unauthorized entry.

   d. All TV’s, smart boards, furniture, books and clocks, moveable objects will be removed as indicated in Section 01 1000 Summary of Work. Items to remain, including fixed furniture, etc. shall be cover with a six mil plastic by the Contract #1 General Construction. Contractor.

4. Contract #1 General Construction Contractor shall provide labor for daily cleanup on the interior of the building as required or directed by the Construction Manager. Any visible debris shall be removed prior to occupancy the following day.

5. All debris shall be disposed of properly in accordance with Federal, State and Local Regulations. Refer to Section 01 5000 - Temporary Facilities and Controls and asbestos and lead abatement sections for containers required.

6. Do not leave any openings unprotected at end of work day or during periods of excessive cold weather or precipitation.

3.6 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Saw cut all concrete slabs and asphalt paving.

E. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

F. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

G. Make neat transitions between different surfaces, maintaining texture and appearance.

3.7 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.

2. Report discrepancies to Construction Manager before disturbing existing installation.

3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 .

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.

2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.

1. Remove items indicated on drawings.

2. Relocate items indicated on drawings.

3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to Mechanical , plumbing and electrical contracts.): Remove, relocate, and extend existing systems to accommodate new construction.

1. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

2. Where existing active systems serve occupied facilities, but are to be replaced with new units, systems and services, replacement shall not occur until new units are on site**.**

a. Identify new equipment installed, but not in service, with appropriate signage or other forms of identification. indicating "Not in Service"**.**

b. Disable existing systems only to make switchovers and connections; minimize duration of outages.

c. Remove existing systems and install new only after scheduling with the Construction Manager in order to minimize duration of outages to units serving occupied areas.

d. See Section 01 1000 - Summary of Contracts for other limitations on outages and required notifications.

e. Provide temporary connections as required to maintain existing systems in service.

f. Perform all switchovers, shutdowns, etc after hours, weekends, holidays or times when the building is not occupied. All switchover scheduling shall be approved by the Construction Manager.

3. Verify that abandoned services serve only abandoned facilities.

4. Remove conduits, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.

4. Patch as specified for patching new work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

1. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

2. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:

1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.

2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before removals is complete.

M. Comply with all other applicable requirements of this section.

3.8 CUTTING AND PATCHING

A. This Section includes procedural requirements for cutting and patching.

B. Contractor acknowledges that the work involves renovation and alteration of existing improvements and, therefore, cutting and patching of the work is essential for the Project to be successfully completed. Contractor shall perform any cutting, altering, patching and fitting of the work necessary for the work and the existing improvements to be fully integrated and to present the visual appearance of an entire, completed, and unified project. In performing any work which requires cutting, fixing, or patching, Contractor shall use its best efforts to protect and preserve the visual appearance and aesthetics of the project to the reasonable satisfaction of both the Architect and Construction Manager.

C. Each Contractor shall do all cutting, patching, repairing as necessary for their work. In all cases, the cutting, patching, repairing and finishing shall be performed mechanics skilled in the particular trade required at no additional cost to the Owner.

D. Whenever possible, execute the work by methods that avoid cutting or patching.

E. See Alterations article above for additional requirements.

F. Refer to other Sections for specific requirements and limitations applicable to cutting and patching.

G. Refer to various sections and divisions for other requirements and limitations applicable to cutting and patching.

H. Perform whatever cutting and patching is necessary to:

1. Complete the work.

2. Fit products together to integrate with other work.

3. Provide openings for penetration of mechanical, electrical, and other services.

4. Match work that has been cut to adjacent work.

5. Repair areas adjacent to cuts to required condition.

6. Repair new work damaged by subsequent work.

7. Remove samples of installed work for testing when requested.

8. Remove and replace defective and non-complying work.

I. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

J. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

K. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

L. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition. A sufficient time in advance of the construction of new walls, floors, or pavement etc. Each Contractor shall be responsible for properly locating and providing in place all sleeves, inserts and forms required for work.

M. Cutting: All cutting of holes in existing existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. .

1. Whenever possible, execute the work In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Section 31 2316 - Excavation where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. All cutting of holes in existing walls, existing floors, existing roofs, and existing ceilings, etc. for the removal of any existing work (including, but not limited to ducts, fans, fixtures, motors, equipment, drains, wiring, conduit, etc.) or for the installation of any new work shall be done in a neat manner by the Contractor. Debris caused by such cutting or removals will be removed by the Contractor unless noted otherwise.

7. Where sleeves, inserts or openings are required in existing walls, floors, and roofs of existing buildings or structures, all necessary cutting, furnishing and installing of sleeves, inserts, lintels, etc., shall be done by each Contractor unless noted otherwise.

N. All surfaces where existing items are removed from existing walls, floors, roofs, and pavements, etc. shall be patched to match existing surfaces by each Contractor.

1. Proceed with patching after construction operations requiring cutting are complete.

O. Fit work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

P. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

Q. Patching:

1. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible.

Provide materials and comply with installation requirements specified in other Sections of these Specifications.

2. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

3. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

4. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

5. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

R. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

1. Match color, texture, and appearance.

2. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.9 SPECIAL REQUIREMENTS

A. Notwithstanding anything contained in the Contract Documents to the contrary, the Contractor(s) shall not be permitted to disrupt operation of any building system or any of the services without Construction Manager's prior written consent, which shall not be unreasonably withheld. Any request to perform such work shall be in writing, received by Construction Manager no less than five (5) working days prior to the commencement of the request for disruption, and shall detail:

1. The exact nature and duration of such interruption;

2. The area of the Building affected, and;

3. Any impact upon the Construction Schedule caused by such proposed temporary disruption. All Work shall be performed during the hours and on the days set forth in the Specifications.

3.10 FIRE PREVENTION AND CONTROL

A. Refer to Section 01 3553.

3.11 UNDERGROUND UTILITIES

A. Broken utilities from work are the responsibility of the Contractor performing the work. Use extreme caution when uncovering utilities. If a utility is broken while uncovering because the utility was not in the exact location identified, the cost of repair is the responsibility of the Contractor.

3.12 WATCHMAN

A. The Owner will not provide watchman. Each Contractor will be held responsible for loss or injury to persons or property or work where his work is involved and shall provide such watchman and take such precautionary measures as he may deem necessary to protect his own interests.

3.13 SECURITY SYSTEM

A. Refer to 01 3553 - Security Procedures

3.14 VERIFICATION OF CONDITIONS

A. All openings, measurements, door frames, existing conditions and other similar items or conditions shall be field measured prior to submission of any shop drawings or manufacturers literature for approval.

1. Each Contractor shall investigate each space into and through which equipment must be moved. Equipment shall be shipped from manufacturer in sections, of size suitable for moving through restricted spaces. Where sectional fabrication and or delivery cannot be achieved, openings, enlargements etc shall be provided by Each contractor whose equipment requires access, at no additional cost to the Owner.

3.15 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

E. Each Contractor is responsible for own daily debris removal into containers provided by the Contract #1 General Construction Contractor. Interior work areas are to be broom swept on a daily basis by the Contract #1 General Construction Contractor.

F. Site Contractor is is responsible to provide for its own daily debris removal and dust protection for their construction-related activities.

G. If daily cleaning and dust protection is not provided the Contractor will be back charged for cleanup performed by employees of the Construction Manager or a separate contractor retained by the Owner's Representative.

3.16 PROTECTION OF INSTALLED WORK

A. Each Contractor is responsible to provide protection for their work.

B. Protect installed work from damage by construction operations.

C. Provide special protection where specified in individual specification sections.

D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

1. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

H. Prohibit traffic from landscaped areas.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.17 SYSTEM STARTUP

A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.

B. Coordinate schedule for start-up of various equipment and systems.

C. Notify Construction Manager 5 days prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.18 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.19 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, balancing and Adjusting HVAC. Refer to Division 23.

3.20 FINAL CLEANING

A. Final cleaning shall be the responsibility of the Contract #1 General Construction Contractor for all interior cleaning and all costs for final cleaning shall be included in the Base Bid. Final cleaning responsibility shall be limited to all areas where renovations occur.

B. Contract #5 Site Contractor shall be the responsibility and pay all costs for final exterior cleaning under their contract.

C. Execute final cleaning after Substantial Completion but before making final application for payment.

D. Use cleaning materials that are nonhazardous.

E. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces

F. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

G. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

H. Replace filters of operating equipment.

I. Clean site; sweep paved areas, rake clean landscaped surfaces.

J. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

K. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

L. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

M. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

N. Remove tools, construction equipment, machinery, and surplus material from Project site.

O. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

P. Sweep concrete floors broom clean in unoccupied spaces.

Q. Remove labels that are not permanent.

R. Touch up and otherwise repair and restore marred, exposed finishes and surfaces evidence of repair or restoration. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show

S. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

T. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

U. Leave Project clean and ready for occupancy.

V. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.21 CLOSEOUT PROCEDURES

A. Refer to Section 01 7800

SECTION 01 7123
FIELD ENGINEERING

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall be responsible for the performance of all engineering tasks required which may include, but not be limited to:
   1. Daily reports submitted each day when requested by the Owner with all pertinent information pertaining to the project including:
      a. Number of employees.
      b. Subcontractor employees.
      c. Breakdown of employees by trade.
      d. Materials installed.
      e. Major construction equipment utilized.
      f. Location of all work areas and materials received.
   2. Provide all surveying equipment required including transit, level, stakes and required accessories.
   3. Furnish all required lines, State Plane coordinates, grades and staking for construction work. All staking shall be performed by a Licensed Surveyor. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials, and equipment.
   4. Maintain field office files and drawings, record drawings, and coordinate engineering services with subcontractors. Prepare layout and coordination drawings for construction purposes.
   5. Check and coordinate work for conflicts and interferences and advise the Engineer in field inspections and field testing, as required.
   6. Cooperate with the Engineer in field inspections and field testing as required.
   7. Develop and make all detail measurements needed for construction for equipment layouts, field-verification of all existing and proposed piping and equipment related to the Project and as directed by the Engineer.
   8. Keep neat legible notes and sketches of all measurements and calculations made while laying out the Work.
   9. Provide civil, electrical, and mechanical engineering specified, required or as directed by the Engineer to solve unexpected problems, provide solutions and recommendations to resolve problems, field questions, and execute Contractor’s construction methods.
   10. Provide the services of additional qualified engineers to address specific equipment installation, operation or performance issues as directed by the Engineer.

11. The Contractor shall be responsible for all costs associated with any professional services required to design and certify repair and installation procedures.

PART 2 PRODUCTS

(Not used)

PART 3 EXECUTION

(Not used)

++END OF SECTION++

SECTION 01 7310
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. This Section includes procedural requirements for cutting and patching.

1. Refer to other Sections for specific requirements and limitations applicable to cutting and patching.

2. Requirements of this Section apply to all contracts. Refer to various sections and divisions of these specifications for other requirements and limitations applicable to cutting and patching.

3. Contractor acknowledges that the work involves renovation and alteration of existing improvements and, therefore, cutting and patching of the work is essential for the Project to be successfully completed. Each Contractor shall perform any cutting, altering, patching and fitting of the work necessary for the work and the existing improvements to be fully integrated and to present the visual appearance of an entire, completed, and unified project. In performing any work which requires cutting, fixing, or patching, Contractor shall use its best efforts to protect and preserve the visual appearance and aesthetics of the project to the reasonable satisfaction of both the Owner and the Architect.

4. Each Contractor shall do all cutting, patching, repairing as necessary for their work In all cases, the cutting, patching, repairing and finishing shall be performed by mechanics skilled in the particular trade required at no additional cost to the Owner.

1.3 RELATED SECTIONS

A. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

B. Divisions 2 through 14 Sections for additional requirements and limitations applicable to cutting and patching individual parts of the Work.

C. Requirements in this Section apply to each contractor and installations. Refer to all Division Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.4 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.5 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching; show how they will be performed, and indicate why they cannot be avoided.

2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.6 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.

a. Air or smoke barriers.

b. Fire-protection systems.

c. Control systems.

d. Communication systems.

e. Conveying systems.

f. Electrical wiring systems.

g. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.

a. Membranes and flashings.

b. Exterior curtain-wall construction.

c. Equipment supports.

d. Piping, ductwork, vessels, and equipment.

e. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

B. Prior to cutting and patching verify with Construction Manager all existing warranties in effect.

1. Portions of the exist roofs are under warranty. Work must be reviewed and approved by the manufacturer of the warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

B. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition. A sufficient time in advance of the construction of new walls, floors, pavement, or roofing etc. Each Contractor shall be responsible for properly locating and providing in place all sleeves, inserts and forms required for work.

C. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

D. All cutting of holes in existing walls, existing floors, existing roofs, existing ceilings, etc. for the removal of any existing work (including, but not limited to ducts, fans, fixtures, motors, equipment, drains, wiring, conduit, etc.) or for the installation of any new work shall be done in a neat manner by each Contractor. Debris caused by such cutting or removals will be removed by each Contractor.

E. Where sleeves, inserts or openings are required in existing walls, floors, roofs, vaults and pavements of existing buildings or structures, all necessary cutting, furnishing and installing of sleeves, inserts, lintels, etc., shall be done by each Contractor.

F. Contractor(s) are hereby notified that the existing walls in the existing building are concrete mansory unit. All openings in existing walls shall be provided with steel lintels, minimum 4" bearing each side and 8" wide x wall thickness concrete masonry units filled solid on each side of the opening for proper support.

G. Adequate blocking, fastening, etc., required to support equipment, casework, etc., from existing terra cotta walls shall be included as required to complete work.

H. All surfaces where existing items are removed from existing walls, floors, ceilings, roofs, vaults, etc. shall be patched to match existing surfaces.

1. All patching shall be provided with prime and finish paint or other material to match existing. In areas indicated to be completely painted/finished by the Contractor for Construction , other prime contractors shall be required only to patch existing surfaces to match as required to accept new finishes.

2. Proceed with patching after construction operations requiring cutting are complete.

I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.4 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WASTE MANAGEMENT REQUIREMENTS

A. Edgemont Union Free School District requires that this project generate the least amount of trash and waste possible.

B. Contract #1 General Construction Contractor shall be responsible for Construction Waste Management for all work in the interiors of the buildings.

1. Site Contractor responsible for waste for all work on the exteriors of the buildings.

C. Each Contractor shall collect and dispose of waste material into containers provided by Contract #1 General Construction Contractor for interior work.. Refer to Section 01 5000 - Temporary Facilities and Controls for disposal by each Contractor for unit ventilators, heaters, fans, toilet fixtures, light fixtures, and etc.

D. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

E. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

F. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:

1. Aluminum and plastic beverage containers.

2. Corrugated cardboard.

3. Wood pallets.

4. Clean dimensional wood.

5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing.

6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

7. Glass.

8. Gypsum drywall and plaster.

9. Plastic buckets.

10. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.

11. Paint.

12. Windows, doors, and door hardware.

13. Mechanical and electrical equipment.

14. Fluorescent lamps (light bulbs).

15. Acoustical ceiling tile and panels.

G. General Construction Contractor and Site Contractor shall submit periodic Waste Disposal Reports to Construction Manager; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

H. General Construction Contractor shall develop and follow a Waste Management Plan designed to implement these requirements for interior work. Site contractor to provide for exterior work.

I. The following sources may be useful in developing the Waste Management Plan:

J. Methods of trash/waste disposal that are not acceptable are:

1. Burning on the project site.

2. Burying on the project site.

3. Dumping or burying on other property, public or private.

4. Other illegal dumping or burying.

5. Incineration, either on- or off-site.

K. Regulatory Requirements: Each Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.3 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 7000 - Execution: Trash/waste prevention procedures related to cutting and patching, installation, protection, and cleaning.

E. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.4 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Waste Management Plan: Include the following information:

1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.

2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).

3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.

4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.

5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.

6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.

1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.

2. Submit Report on a form acceptable to Construction Manager.

3. Landfill Disposal: Include the following information:

   a. Identification of material.

   b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.

   c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.

   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

4. Recycled and Salvaged Materials: Include the following information for each:

   a. Identification of material, including those retrieved by installer for use on other projects.

   b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.

   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.

   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.

5. Material Reused on Project: Include the following information for each:

a. Identification of material and how it was used in the project.

b. Amount, in tons or cubic yards.

c. Include weight tickets as evidence of quantity.

6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor and Construction Manager.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.

1. Prebid meeting.

2. Preconstruction meeting.

3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

1. Provide containers as required.

2. Provide adequate space for pick-up and delivery and convenience to subcontractors.

3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

SECTION 01 7600
PROCEDURES AND SPECIAL CONDITIONS FOR SEPARATE PRIME CONTRACTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. The types of minimum requirements for procedures and performance or control work of a general nature, to be fulfilled collectively by Prime Contractors, and must be participated in by each Prime Contractors (where applicable) even though certain lets of work may be assigned to a specific Prime Contractors.

1.3 USE OF PREMISES

A. Refer to Section 01 1000 Summary of Contract(s).

1.4 MISCELLANEOUS PROVISIONS:

A. Except as otherwise indicated comply with applicable requirements of Division-22, 23, and 26 sections for mechanical provisions within units of general (Divisions 2-14) work. Except as otherwise indicated, comply with applicable requirements of Division-26 section for electrical provisions within units of general (Divisions 2-14) work.

B. Service Connections: Refer to Division-22, Division-23 and Division-26 sections for the characteristics of the mechanical and electrical services to be connected to units of general work. Provide units manufactured or fabricated for proper connection to and utilization of available services, as indicated. Except as otherwise indicated, final connection of mechanical services to general work is defined as being mechanical work, and final connection of electrical services to general work is defined as electrical work.

1.5 DISSIMILAR METAL

A. Wherever dissimilar metals would otherwise come in contact with each other, they must be isolated by use of an approved, permanent non-staining material. Where one of the metals is aluminum, a coat of zinc-chromate primer followed by a coat of alkali-resistant bituminous paint shall be applied.

1.6 MODIFICATION OF WORK

A. Where necessary, because of job or space conditions, the Contractor shall modify his work to suit these conditions, within accepted standards and limitations. No allowance will be made for this modification. .

1. If work is executed without regard for other trades as cited above, the Architect may direct its removal and modification. No allowance will be made for this work.

1.7 ACCESSIBILITY, SIZE AND LOCATION OF EQUIPMENT AND WORK

A. Each Contractor shall investigate each space into and through which equipment must be moved. Equipment shall be shipped from manufacturer in sections, of size(s) suitable for moving through restricted spaces.

B. Each Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and sizes of duct enclosures, for the proper installation of his work. They shall cooperate with the all other contractors whose work is in the same spaces and shall advise the Construction Contractor of their requirements. Such spaces and clearances shall, however, be kept to the minimum size required.

C. Each Contractor shall locate all equipment, which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to: valves, traps, cleanouts, motors, controllers, switch-gear, and drain point etc. Minor deviations from drawings may be made to allow for better accessibility, but changes of magnitude or which involves extra cost shall not be made without approval.

1.8 ACCESS DOORS

A. Provide all access doors for all dampers, valves, cleanest, junction boxes, pull boxes or similar items located above finished ceilings or ceiling breaks or extensions, behind finished walls or below finished floors. The access doors shall be stainless steel or steel, hinged types as required for type of construction.steel, hinged types as required for type of construction.

1. Where feasible locate all dampers, valves, cleanest, junction boxes, pull boxes or similar items above acoustical tile ceiling.

2. Provide where required:

    a. Wall and ceiling access door and frame units.

    b. Floor access door and frame units, interior.

    c. Access door and frame units, fire-rated and non-fire-rated, in wall, ceiling, and floor locations.

3. Group together concealed boxes, control valves, dampers and other mechanical and electrical equipment requiring access for operation, maintenance and repair, to reduce number of access doors required.

4. Group together concealed boxes, control valves, dampers and other mechanical and electrical equipment requiring access for operation, maintenance and repair, to reduce number of access doors required.

5. Where electric motors or heaters are installed above hung ceilings, provide disconnect switch in hung ceilings within reach from access doors, unless switch is located on wall immediately below.

    a. Disconnect switch shall be provided by the Contractor furnishing the equipment unless shown otherwise.

6. All access doors in Toilets, Janitor Closets, and Kitchen and Food Related Areas and similar spaces shall be watertight and constructed completely of stainless steel type 302.

7. In new construction each contractor shall furnish the access dorr(s) to the General Construction Contractor for installation. In existing construction each Prime Contractor shall furnish and install.

1.9 MACHINERY GUARDS

A. Moving parts of machinery exposed to contact by personnel shall be guarded by a barrier of a type a approved by the Architect.

1. Exposed moving parts such as belts and couplings shall have 3/4" No 16 gauge galvanized expanded metal mesh guards, with all edges rounded. Guards shall be 1-1/2" x 1-1/2" x 1/8" angle iron framed properly supported.

2. All machinery guards covering the ends of motor or equipment shafts shall have openings for the insertion of a tachometer.

1.10 DRIP PANS

A. The respective mechanical contractor shall provide 20 oz. copper all soldered reinforced pans with 2" high lips under all heating, domestic water piping, soil and waste piping which runs over electric switchboards, mounting boards, motors or electric motor starters. Each drip pan shall have a copper drain piped to discharge where shown on the drawings, of if not shown, to discharge to the nearest available open drain or floor where directed by the Owner's Representative. All piping shall be copper 1-1/2" minimum in diameter.

1.11 CONCEALMENT OF UNSIGHTLY INSTALLATIONS

A. Piping and conduit work is to be run concealed in all occupied areas, in partitions, construction and pipe spaces. Obtain exact dimensions locations of partitions, use special care to see that no joints, fittings, piping or conduit will be exposed except as shown or specified. In the event of any unsightly exposed piping or conduit work or unsightly partitions resulting, the Contractor shall rebuild, and re-run lines at his own expense. When approved by the Owner's Representative all exposed conduit shall be installed in wiremold.

1.12 SUPPORTS FROM OVERHEAD CONSTRUCTION

A. Where overhead equipment does not permit fastening of supports for equipment, furnish at no additional cost to the Owner, additional framing, supplementary steel, etc., as required, subject to approval by the Owner's Representative. Specific types of hangers and supports which are required in certain areas are to be installed as indicated on the drawings.

1.13 ESCUTCHEONS

A. Where exposed un-insulated mechanical piping or conduits pass through floors, ceilings or walls of finished rooms, apply, approved hinged escutcheon of sufficient outside diameter to cover the pipe sleeve.

1. Where exposed insulated pipes pass through walls, floors, or ceilings of finished rooms, provide escutcheons fastened to the sleeves.

2. Finish shall be stainless steel in toilets, janitor’s closet and similar “wet areas”. Submit samples.

1.14 FLASHINGS

A. Cap Flashing:

1. Unless noted otherwise on drawings all cap flashings for HVAC, Plumbing and Electrical work shall be provided by the respective HVAC, Plumbing and Electrical Contractor, except where specifically indicated or specified to be provided by the General Construction Contractor.

a. Unless noted othewise on drawings cap flashings for all contracts shall conform to Section 07600 Flashing and Sheetmetal and shall be a minimum 16 oz.. lead coated copper. Provide a minimum 4" lap extending over the base flashing.

B. Base Flashing:

1. All base flashings and pitch pockets for all contracts to be installed in new roofing system shall be provided by the Construction Contractor.

a. All base flashing and pitch pockets for equipment installed on existing roof systems shall be furnished and installed by the Construction Contractor. Work shall be compatible to existing roofing system and performed by installers acceptable to the roofing manufacturer so as not to void any existing roofing warranties. Prior to starting work on existing roof systems notify Owner's Representative and roofing manufacturer.

b. Unless noted othewise on drawings all base flashing shall be a minimum 12" above roof membrane.

1.15 WATERPROOFING

A. Where any work pierced waterproofing, including waterproof concrete, the method of installation shall be approved by Owner's Representative before work is done. Each Contractor shall furnish all necessary sleeves, caulking and flashing required making openings absolutely watertight. (See Cutting and Patching Section 01700)

1.16 SALVAGEABLE MATERIALS:

A. The Owner will prepare a list of salvageable items it wishes to retain. All salvageable items shall be delivered by the Contractor to a storage area designated by the Owner on site. All demolished equipment etc., except those items specifically requested by the Owner shall become the Contractor's property and shall be removed from the premises.

1.17 CONSERVATION:

A. General: It is a requirement for each Prime Contractor's supervision and administration of the work, that construction operations be carried out with the maximum possible consideration given to conservation of energy, water and materials.

1.18 MATERIALS AND WORKMANSHIP

A. All material, apparatus and accessories shall be new and of the best quality of their respective kind.

1. Work and materials shall conform to the latest applicable requirements of the New York State Building Code including Reference Standards or National Board of Fire Underwriters and Local Municipal codes, where applicable.

2. All labor shall be performed in a first-class workmanlike manner, and adequate supervision must be provided to insure against neglect or faulty installations of any part of the systems during the progress of the work.

3. Any inferior material and/or workmanship shall be removed at once, when directed by the Owner's Representative and replaced with material and workmanship in accordance with the true intent and meaning of the drawings and specifications, at no additional cost to the Owner.

4. If material or equipment is installed before it is approved, as to manufacture and shop drawings, the Contractor shall be liable for the removal and replacement at no extra charge, if in the opinion of the Owner's Representative the material or equipment does not meet the intent of the drawings and specifications.

5. If after installation (with or without prior approval) operation of any equipment proves to be unsatisfactory by reasons of defects, workmanship, error or omissions, the Owner's Representative reserves the right to operate equipment until it can be removed from service for correction or replacement by the Contractor. The Contractor shall pay for the repair of all damage to work of other Prime Contractor's caused by this defective equipment and its correction or replacement.

6. No advertising matter exclusive of nameplates containing required data shall appear on any equipment without the written consent of the Owner's Representative. The equipment furnished under this specification shall be essentially the standard product of a manufacturer regularly engaged in the manufacture of such equipment. Where two or more units of the same class of equipment are required, the units shall be products of a single manufacturer; however, the component parts of the equipment need not be products of the same manufacturer.

1.19 SELECTIVE REMOVAL OF EXISTING PLUMBING, HEATING, ELECTRICAL AND RELATED WORK

A. All selective removal work shall be in accordance with the time schedule as specified herein.

1. All plumbing, mechanical and electrical removals shall be performed as required to complete the work as intended.

2. Remove all plumbing, heating and electrical apparatus, equipment, specialties, drains, controls, hangers, bases supports, piping, pneumatic tubing, conduit, panels, switches, wiring, plumbing accessories and electrical fixtures, etc., that are not incorporated in the new layout or required.

3. Where removal is indicated, or implied, or not incorporated in the new layout, the item itself is to be removed completely together with all connecting conduits, specialties, supports, controls, etc. Connecting conduits are to be removed back to the mains and panels where they are to be capped or disconnected. All abandoned open ends shall be sealed and capped or disconnected. This includes all heating, electric, water, gas, etc. Patching and finishing of all surfaces to match existing shall be performed by the Contractor doing the removal. (See Cutting and Patching Section 01700)

4. Where existing conduit, etc., enter inaccessible trenches, tunnels, shafts, walls, and ceilings, inside of the existing building, they shall be cut back at least 2" into such inaccessible spaces and shall be suitably capped and sealed by the Contractor.

5. Each Contractor shall exercise all normal caution to prevent unnecessary cutting and damage to the existing building. Any excessive damage, as determined by the Owner's Representative shall be repaired and paid for by the Contractor causing the damage.

1.20 ELIMINATION OF NOISE AND VIBRATION

A. All equipment and accessories shall operate without objectionable noise or vibration.

1. Should operation of any one or more of the systems produce noise or vibration which is, in the opinion of the Owner's Representative, objectionable, the Contractor shall, at his own expense, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.

2. All work shall operate under all conditions of load without any sound or vibration which, in the opinion of the Owner's Representative, is objectionable. In the case of moving machinery, sound or vibration noticeable outside the room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Owner's Representative shall be corrected in an approved manner by the Contractor at his expense.

a. Provide vibration isolators on all moving machinery.

1.21 GENERAL LABELING

A. All mechanical and electrical equipment such as unit ventilators, heating and ventilating units, exhaust fans, etc., shall have appropriate descriptive labels, identification tags and nameplates, furnished and installed under the respective control under which the corresponding item is provided, and shall be properly placed and permanently secured to (or adjacent to) the item being installed.

1. Submit complete schedules, listings, and descriptive data, together with samples for checking and approval before purchasing.

2. Refer to respective M/E specifications for additional requirements.

1.22 IDENTIFICATION OF PIPING

A. Each Contractor shall provide on all new exposed, insulated and uninsulated piping, semi-rigid, wrap-around plastic identification markers.

1. Each marker background is to be appropriately color-coded with a clearly printed legend to identify the contents of the pipe conformance with the Scheme for the Identification of Piping Systems (ASA A13.1-1956). Direction of flow arrows is to be included on each marker.

2. Exposed locations for the pipe markers to be as follows:

a. Adjacent to each valve.

a) At each branch and riser take-off.

b) At each pipe passage through wall, floor and ceiling construction.

c) On all horizontal pipe runs - marked every 15 feet.

d) At each inlet and outlet of coils, pumps, etc.

3. Refer to respective M/E specifications for additional requirements.

1.23 PAINTING

A. All apparatus, cabinets, etc., furnished under the Mechanical and Electrical Sections of the specifications, shall be provided with a priming coat, and enamel finish. All patched surfaces and surfaces where removals have occurred (by each Contractor) shall receive a prime coat and a finish coat to match adjacent surfaces acceptable to the Owner's Representative unless noted otherwise.

1. All finish painting of new insulated and uninsulated piping, new duct work, apparatus, and appurtenances, will be performed by each contractor, unless noted otherwise.

2. All concealed supports and ironwork not otherwise protected against corrosion shall be given two (2) coats of bituminous base paint.

1.24 TEMPLATES:

A. Each contractor shall prepare templates showing all dimensions and shall furnish all anchor bolts and sleeves required for all equipment,, boilers, and transformers, etc., and submit to Contractor who requires this information.

1.25 EQUIPMENT BASES

A. Each contractor shall submit for approval of the Fuller and D'Angelo, P.C., detail drawings of all equipment foundations and shall furnish all templates for his foundation.

1. Unless otherwise indicated Construction Contractor will furnish and install their equipment bases. It is the responsibility of each Contractor to place any templates and anchor bolts and to supervise the construction of the equipment bases regardless of who installs the bases.

a. Concrete equipment bases for shall be minimum 3,000 psi test strength at 28 days . Provide minimum 6/6 x 10/10 welded wire mesh.

1.26 MOTORS

A. Each Contractor shall furnish and install the electric motors required for the motor-driven equipment supplied under his contract. The motors shall be of sufficient size for the duty to be performed, and shall not exceed their full rated load when the driven equipment is operating at required capacity under the most severe conditions likely to be encountered. The speed and horsepower for each motor are given in the schedule on the drawings, or are specified.

1. All motors shall be suitable for operating on alternating current, sixty (60) cycle frequency. Motors 1/2 horsepower and smaller shall be wound for single-phase, 60 cycle, 120 volt current. Motors exceeding 1/2 horsepower shall be designed for operation on three phase, 60 cycle, voltage indicated on the Electrical drawings or specifications current.

a. Fractional horsepower motors shall be of the sealed prelubricated ball bearing type.

a) All motors shall be approved by the Underwriters Laboratories, Inc., for the service and location intended.

b) All motors shall be equipped with ball bearings unless specified otherwise in other sections of these specifications.

c) Motors for single-phase operation shall be of the capacitor type.

1.27 WIRING

A. The wiring of prewired equipment or apparatus is specified under the corresponding sections of the Specifications. The Electrical volt systems design as indicated on the Electrical Drawings and Specifications.

B. The Electrical Contractor will perform all Power wiring; however, each Contractor shall furnish all magnetic starters and automatic controls, suitable for the equipment furnished by the Contractor. Motor starters shall be installed by the Electrical Contractor.

C. Each Contractor shall prepare wiring diagrams and submit same for approval Submit in electronic PDF format.Approved copies with any additional instructions are to be given to the Electrical Contractor.

1. All prewired and job wired control panels for motors shall be provided with approved high interrupting capacity circuit breakers.

2. All electrical wiring for equipment where exposed to the weather (factory or field installed) shall be installed in weathertight conduits and shall be U.L. approved.

1.28 CONTROL WIRING

A. Control wiring is required wiring, conduit, relays, contractors, electro-mechanical, hydraulic activators and solid state regulating devices either low or line voltage, to the controlled device that is regulated by the controller and necessary for the operation, controlling, sequencing etc. of the equipment or system. Control wiring shall be furnished and installed by each contractor furnishing and installing such equipment or systems.

1. Power wiring to equipment, including wiring and installation of magnetic starters and disconnect switches, where required, shall be the responsibility of the Electrical Contractor. The Electrical Contractor shall furnish and install all disconnect switches, where required, and install all magnetic starters. All magnetic starters shall be furnished by each contractor furnishing the equipment or systems.

2. EachContractor shall supervise the wiring of all equipment included under his Contract.

1.29 MOTOR STARTERS

A. Except where specified to be motor or pedestal mounted as part of a prewired control panel furnished with the equipment they serve, all magnetic starters shall be provided by each Contractor. Magnetic starters, with thermal and under voltage protection, suitable for the voltages indicated, shall have a heater in each phase and reset button on the cover.

1. Motors 1/2 HP and larger shall have Allen Bradley, Emerson Phase Guard or approved substitute phase failure relays suitable for the voltages indicated, included in the starter enclosure. Refer to specific section of specifications for special starters.

B. Motors over 1 HP shall be provided with variable frequency drive. (VFD), unless shown otherwise

C. Where the installation of phase failure non-reversing relays are required, these shall, wherever possible, be wired and installed at the equipment manufacturer's factory panel mounted equipment in connection with refrigeration equipment and temperature controls. Starters shall be Allen Bradley, Square D or approved equal.

1.30 UNDERWRITERS' LABORATORIES CERTIFICATION

A. All mechanical and electrical equipment shall bear the UL label of approval where such inspection service is furnished for the particular type of equipment.

1.31 LOCATIONS AND MEASUREMENTS

A. The locations of fixtures, appliances, conduits, etc., are specified and shown on the plans as accurately as possible, but in all cases, they are to be adjusted to the surrounding conditions. Contractor must take all measurements at the building, and should the space allotted for any appliance be inadequate, it shall be the Contractor's responsibility to immediately notify in writing, and shall he fail to do so, he must bear the expense necessary to correct the conditions. All work shall be coordinated with the work of other trades.

1.32 GROUNDING

A. Standards set forth by the latest edition of the National Electric Code, relative to the grounding of system and equipment, shall be followed together with the rules and regulations of the Utility Company. All non-current carrying metal parts shall be solidly grounded. All motor frames that are not clamped to supply conduits shall be grounded by suitable wire and ground clamp.

1. The identified neutral wire or white wire of the interior wiring system shall be permanently grounded to the water services. The grounded wire shall be connected to the supply side of the main service switch and mechanically connected to an approved ground clamp and securely bonded to the water service at the point of entry. The ground connection shall be made on the supply side of the first main control valve. The conductors shall be protected from mechanical injury by rigid steel conduit to which the conductors shall be securely bonded in each length of connection. Conduit system shall be securely grounded to the above described ground of wiring system.

2. Ground connections to water mains shall be made to non-current carrying metal parts of distribution panels, instrument cases, and instrument transformer cases.

1.33 FIRESTOPPING:

A. All openings thru walls, floors, shafts, etc. shall be fire stopped with approved material to maintain rating. See Section 07 8400 - Firestopping.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Substantial Completion.

B. Final Completion.

C. Project record documents.

D. Operation and maintenance data.

E. Warranties

1.3 RELATED REQUIREMENTS

A. Article 14 and 15 of the General Conditions:

B. Section 01 3000 - Administrative Requirements: Submittals procedures.

C. Section 01 7000 - Execution: Progress and Final cleaning.

D. Section 01 7900 - Demonstration and Training.

E. Section 01 9113 - General Commissioning Requirements.

F. Individual Product Sections: Specific requirements for operation and maintenance data.

G. Individual Product Sections: Warranties required for specific products or Work.

1.4 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion:

1. Prepare a list of items to be completed and corrected, the value of items on the list, and reasons why the Work is not complete.

2. Advise Architect and Construction Manager of pending insurance changeover requirements.

3. Obtain and submit releases permitting Architect and Construction Manager unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

B. Prior to issuance of the Certificate of Substantial Completion, submit, in writing, a request to the Architect and Construction Manager to perform site inspection for the purpose of preparing a "punch list".

C. On receipt of request the Architect and Construction Manager will schedule and prepare a punch list.

D. Certificate of Substantial Completion will be issued **only after completion of all punch list items, including photos of corrected items,** or Construction Manager will notify each Prime Contractor of items, either punch list or additional items identified by Architect, **that must be completed or corrected before a certificate will be issued.** After completion of **all punch list items** submit the following:

1. Application for Payment showing 100 percent completion for portion of the Work claimed as substantially completed.
2. Manufacturer's Warranties/guarantees.
3. Contractor's Warranty - Three years minimum except where longer periods are prescribed or there is an extended warranty.
4. Maintenance agreements, if any.
5. Manifest for disposal of Hazardous Material.
6. Manifest for disposal of material.
7. Test/adjust/balance reports and records.
8. Maintenance Manuals and Instructions Manuals
9. Signed Receipt by Construction Manager of spare parts and attic stock, if any.
10. Start-up performance reports.
11. Changeover information related to Owner's occupancy, use, and maintenance.
12. Video Training Sessions.
13. Advice on shifting insurance coverage.
14. All third party inspections including concrete, steel, rebar, manufactures field inspection, etc.
15. List of incomplete Work, recognized as exceptions to Architect's and Construction Manager's "punch list".
16. Removal of temporary facilities and services.
17. Removal of surplus materials, rubbish and similar elements.
18. As Built Drawings.
19. Project Record Documents.
20. Fully executed Certificate of Substantial Completion. (AIA G704 by Architect).

21. Asbestos manifest, if any.

22. Underwriters Certificate or authorized third party Certificate.

23. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

E. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1. If necessary re-inspection will be repeated and the contractor shall pay for all additional inspections as per amount stated in the General Conditions..

2. Results of completed inspection will form the basis of requirements for Final Completion.

3. The maximum payment for Substantial Completion shall 100% of contract amount, **less 5% retainange.** The retainage will be paid when all Final Completion items are submitted and approved.

1.5 FINAL COMPLETION AND PAYMENT

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify each Prime Contractor of unfulfilled requirements. Architect and Construction Manager will not process a final Certificate for Payment until after the inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

a. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

b. At the completion of each “punch list” item the each Prime Contractor shall photograph each item and submit them to Construction Manager.

B. Following Final Inspection and acceptance of work submit the following: (As applicable to each Prime Contractor)

1. Submit a final Application for Payment according to Division 1 Section 01 2000 - Price and Payment Procedures.

2. Architect's punch list certifying all punch list items have been completed, with photograph of each item, signed off by the **Construction Manager and each Prime Contractor.**

3. Update final statement, accounting for final changes to the Contract Sum.

4. Consent of Surety to Final Payment, AIA Document G707

5. Final Liquidated Damages settlement statement.

6. Contractor's Affidavit of Release of Liens (AIA G706A).

7. Contractors Affidavit of Payment of Debts and Claims (AIA G706)

8. Contractor's Certification of Payment of Prevailing Wage Rates.

9. Contractor's Certification of Compliance that products comply with VOC requirements stated in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

10. Contractor's Certified Statement certifying that no asbestos containing material was incorporated into the project.

11. DOL Final Completion Form. (PW 200).

12. Asbestos Manifest

13. Underwriters Certificate or equivalent.

1.6 SUBMITTALS

A. Each Contractor shall submit all documentation identified in this section within ninety (90) working days from the time the Contractor submits the list of items to be corrected, in addition to other rights of the Owner set forth elsewhere in the Contract Documents, to include but not limited to withholding of final payment. If the documentation has not been submitted within [ninety (90)] day period, the Construction Manager will obtain such through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by the Owner, provided the Owner has advised the Contractor of this action [seven (7)] days prior to the culmination date by written notice.

B. Project Record Documents: Submit documents to Architect with claim for final Application for Payment. Refer to Section 01 1000 Summary of Work for addition information.

C. Operation and Maintenance Data:

1. Refer to individual sections for additional requirements.

2. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Construction Manager and Architect will review draft and return one copy with comments.

3. For equipment, or component parts of equipment put into service during construction and operated by Edgemont Union Free School District, submit completed documents within ten days after acceptance.

4. Submit one copy of completed documents 10 days prior to final inspection. This copy will be reviewed and returned after final inspection with Construction Manager and Architect comments. Revise content of all document sets as required prior to final submission.

5. Submit two sets of revised final documents in final form within 10 days after final inspection.

D. Warranties.

1. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

2. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.
7. O&M Manuals.

B. Ensure entries are complete and accurate, enabling future reference by Construction Manager.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

1. Review with Construction Manager with each application for payment.
2. Construction Manager shall verify record mark-up are up to date.
3. Failure to maintain mark up will be cause for rejecting the application.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawingsand Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

3. Field changes of dimension and detail.

4. Details not on original Contract drawings.

G. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and approved Shop Drawings at the project site.

H. Each Contractor is responsible for marking up Sections that contain its own Work and for submitting the complete set of record Specifications as specified.

I. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

1. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

2. Accurately record information in an understandable drawing technique.

3. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

J. Content: Types of items requiring marking include, but are not limited to, the following:

1. Dimensional changes to Drawings.

2. Revisions to details shown on Drawings.

3. Locations and depths of underground utilities.

4. Revisions to routing of piping and conduits.

5. Revisions to electrical circuitry.

6. Actual equipment locations.

7. Duct size and routing.

8. Locations of concealed internal utilities.

9. Changes made by Change Order or Construction Change Directive.

10. Changes made following Architect and Construction Manager's written orders.

11. Details not on the original Contract Drawings.

12. Field records for variable and concealed conditions.

13. Record information on the Work that is shown only schematically.

K. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

L. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

M. Mark important additional information that was either shown schematically or omitted from original Drawings.

N. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

O. **Provide ALL final record documents on flash drive in PDF-A Format.**

3.2 FORMAT

A. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Contractor shall certify and sign.

B. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record PDF Drawings: Organize PDF information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each PDF file.

D. Identify Record Drawing as follows:

1. Project name.

a. Date.

b. Designation "PROJECT RECORD DRAWINGS."

c. Name of Owner, Architect , Consultants, and Construction Manager.

d. Name of Contractor.

e. Contractor shall certify and sign each drawings or attached TOC as follows:

a) "We the undersigned certify that we have reviewed and coordinated the As-Built Drawings and they are in conformance to the plans, specifications, applicable codes and provisions of the Contract Documents. To the best of our knowledge all items reflected on the As-Built Drawings are a true representation of the site and building conditions".

3.3 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.4 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.5 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.

2. Identify function, normal operating characteristics, and limiting conditions.

3. Include performance curves, with engineering data and tests.

4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

1. Include HVAC outdoor and exhaust air damper calibration strategy.

a. Include provisions which ensure that full closure of dampers can be achieved.

2. Include Carbon Dioxide Monitoring Protocol.

3. Include Carbon Monoxide Monitoring Protocol.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide contractors's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.6 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Edgemont Union Free School District's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Fuller and D'Angelo, P.C., Consultants, Construction Manager, Contractor, and Subcontractors with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.

2. Table of Contents, of all volumes, and of this volume.

3. Operation and Maintenance Data: Arranged by system, then by product category.

a. Source data.

b. Operation and maintenance data.

c. Field quality control data.

d. Photocopies of warranties and bonds.

K. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

1. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3.7 WARRANTIES

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Edgemont Union Free School District's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

CHECKLIST FOR PROJECT CLOSEOUT AND PROCESSING OF FINAL PAYMENT

SUBMIT CHECKLIST WITH CLOSEOUT DOCUMENTS

Project: Seely Place ES & Greenville ES Interior Renovations & Site Improvements

Owner: Edgemont School District

Architect Project #: 24529.03

CLOSE-OUT SUBMITTALS: (As Applicable. Include this checklist with submittal)

SUBSTANTIAL COMPLETION

[ ] UL Certification or equivalent.

[ ] Three (3) Ring Binder Brochures of Operation And Maintenance Manuals For All Equipment Installed on The Project including the following:

[ ] Typed or Printed Instructions Covering The Care And Operations of Equipment And Systems Furnished And Installed.

[ ] Start-up Performance Reports

[ ] Test/Balancing Reports.

[ ] Final Survey

[ ] Manufacturers Instruction Books, Diagrams, Spare Parts Lists Covering All Equipment.

[ ] Instruction of Owner's Representative In Care And Maintenance of New Equipment.

[ ] All Approved Shop Drawings and Submittals.

[ ] Third Party Inspections Reports.

[ ] Field Reports Executed by each Prime Contractor.

[ ] Video Training Sessions.

[ ] Surveys and survey logs.

[ ] Certificates of Compliance And Inspection. (Where Applicable Electric, Elevator, Etc.)

[ ] Spare Parts, O&M and Maintenance Materials. (Receipt Signed By Field Superintendent)

[ ] Evidence of Compliance With Requirements Of Governing Authorities (Certificates Of Inspection Electrical).

[ ] Certificates of Insurance For Products And Completed Operations.

[ ] Fully Executed Certificate of Substantial Completion: AIA G704 (Issued by Architect).

[ ] Construction Manager's Written Two-Year Warranty And Extended Warranties (If Any Required).

[ ] Manufacturer's Warranty/Guaranties

[ ] Manifest for Disposal of Hazardous Material.

[ ] Manifest for Disposal of Material.

[ ] Architect's Punch List Items, **including photographs,** certifying all Punch List have been completed with sign-off by Construction Manager and Contractor.

[ ] Project Record Documents.

[ ] Approved As-Built Drawings. (Printed Copy and PDF Format with corrections if any)

[ ] **All files listed above shall be submitted on USB flash drive**

_____ Date _____

(Authorized signing officer, Title)

FINAL COMPLETION

[ ] Affidavit of Payment of Debts And Claims: AIA G706.

[ ] Affidavit of Final Release of Liens - AIA G706a for all with Lien Right Against The Owner's Property.

[ ] Notarized Statement That Only Non-Asbestos Materials Were Installed On This Project.

[ ] Consent Of Surety To Final Payment AIA G707.

[ ] Certification of Payment of Prevailing Wage Rates.

[ ] Contractor's Certification of Compliance that products comply with VOC requirements stated in Section 01 6116.

[ ] DOL PW 200 Form.

_____ Date _____

(Authorized signing officer, Title)

Final payment will not be processed until all items indicated are received and approved in accordance with Section 01 7800 - Closeout Submittals by the Construction Manager .

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Demonstration of products and systems to be commissioned where indicated in specific specification sections.

B. Training of Edgemont Union Free School District personnel in operation and maintenance is required for:

1. All software-operated systems.
2. Mechanical systems and equipment.
3. Plumbing equipment.
4. Electrical systems and equipment.
5. Items specified in individual product Sections.

C. Training of Edgemont Union Free School District personnel in care, cleaning, maintenance, and repair is required for:

1. Items specified in individual product Sections.

1.3 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

B. Section 01 9113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
2. Make commissioning submittals on time schedule specified by Commissioning Authority.
3. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Edgemont Union Free School District will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to Consruction Manager for transmittal to .
2. Submit to Commissioning Authority for review and inclusion in overall training plan.
3. Submit not less than four weeks prior to start of training.
4. Revise and resubmit until acceptable.
5. Provide an overall schedule showing all training sessions.
6. Include at least the following for each training session:
    a. Identification, date, time, and duration.
    b. Description of products and/or systems to be covered.
    c. Name of firm and person conducting training; include qualifications.
    d. Intended audience, such as job description.
    e. Objectives of training and suggested methods of ensuring adequate training.
    f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    g. Media to be used, such a slides, hand-outs, etc.
    h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of four attendees per training session.

1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Video Recordings: Submit digital video recording of each demonstration and training session for Edgemont Union Free School District's subsequent use.

1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Consruction Manager.

B. Demonstrations conducted during Functional Testing need not be repeated unless Edgemont Union Free School District personnel training is specified.

C. Demonstration may be combined with Edgemont Union Free School District personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Construction Manager will provide classroom and seating at no cost to the Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum of two (2) - two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Edgemont Union Free School District's personnel to be trained; re-schedule training sessions as required by Edgemont Union Free School District; once schedule has been approved by Edgemont Union Free School District failure to conduct sessions according to schedule will be cause for Edgemont Union Free School District to charge the Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.

2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.

3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:

1. Review the applicable O&M manuals.

2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.

4. Provide hands-on training on all operational modes possible and preventive maintenance.

5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.

6. Discuss common troubleshooting problems and solutions.

7. Discuss any peculiarities of equipment installation or operation.

8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.

9. Review recommended tools and spare parts inventory suggestions of manufacturers.

10. Review spare parts and tools required to be furnished by the Contractor

11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within five days.

SECTION 01 9113
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:

1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.

2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.

3. Verify that operation and maintenance manuals submitted to Edgemont Union Free School District are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.

4. Verify that the Edgemont Union Free School District's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

D. The Commissioning Authority is employed by Edgemont Union Free School District.

1.3 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. HVAC System, including:

1. Major and minor equipment items.

2. Piping systems and equipment.

3. Terminal units.

4. Control system.

C. Electronic Safety and Security:

1. Fire and smoke alarms.

D. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.4 RELATED REQUIREMENTS

A. Refer to Section 01 2100 - Allowances for commissioning allowance.

B. Section 01 7800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

1.5 REFERENCE STANDARDS

A. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests; Current Edition.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

1. Submit one copy to the Commissioning Authority, not to be returned.

2. Make commissioning submittals on time schedule specified by Commissioning Authority.

3. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.

B. Product Data: If submittals to Fuller and D'Angelo, P.C. do not include the following, submit copies as soon as possible:

1. Manufacturer's product data, cut sheets, and shop drawings.

2. Manufacturer's installation instructions.

3. Startup, operating, and troubleshooting procedures.

4. Fan and pump curves.

5. Factory test reports.

6. Warranty information, including details of Edgemont Union Free School District's responsibilities in regard to keeping warranties in force.

C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

F. HERS Rating Report: Include the following mandatory completed reports for ENERGY STAR Certified Homes:

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Edgemont Union Free School District.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.

2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.

3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Edgemont Union Free School District; such equipment, tools, and instruments are to become the property of Edgemont Union Free School District.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.

1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Edgemont Union Free School District.

PART 3 EXECUTION

3.1 COMMISSIONING PLAN

A. Commissioning Authority will prepare the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.

2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.

2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.

3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.3 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.

2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.

3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:

a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.

b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.

c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."

d. Serial number of installed unit.

e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.

f. Sensor and actuator calibration information.

4. PECI (Samples) found at http://www.peci.org/library/mcpgs.htm indicate anticipated level of detail for Prefunctional Checklists.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.

4. If any Checklist line item is not relevant, record reasons on the form.

5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.

6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.

7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.

1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.

2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.

3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.

4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:

1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.

2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Edgemont Union Free School District.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.4 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Edgemont Union Free School District; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.

2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.

3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.

4. Contractor shall bear the cost of Edgemont Union Free School District and Commissioning Authority personnel time witnessing re-testing.

5. Contractor shall bear the cost of Edgemont Union Free School District and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.

2. Examples of Functional Testing:

a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation

(e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.

c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.

d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

3. PECI (Samples) found at http://www.peci.org/library/mcpgs.htm indicated anticipated level of detail for Functional Tests.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.5 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:

1. Verify that sensor location is appropriate and away from potential causes of erratic operation.

2. Verify that sensors with shielded cable are grounded only at one end.

3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.

4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:

1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.

2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.

3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.

1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:

1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.

4. Command valve/damper to open; verify position is full open and adjust output signal as required.

5. Command valve/damper to a few intermediate positions.

6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.

1. With full pressure in the system, command valve closed.

2. Use an ultra-sonic flow meter to detect flow or leakage.

3.6 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.

2. Sampling is not allowed for:

a. Major equipment.

b. Life-safety-critical equipment.

c. Prefunctional Checklist execution.

3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.

4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.

5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."

6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.

7. If YY percent of the units in the second sample fail, test all remaining identical units.

8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:

1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.

2. Other points will be monitored by the Commissioning Authority using dataloggers.

3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.

4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.

5. Graphical output is desirable and is required for all output if the system can produce it.

6. Monitoring may be used to augment manual testing.

3.7 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Fuller and D'Angelo, P.C. to manuals prior to submission to Edgemont Union Free School District.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Edgemont Union Free School District.

SECTION 02 6500
UNDERGROUND STORAGE TANK REMOVAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal and disposal of underground storage tanks and connected piping.

B. Cleaning and vapor freeing of tanks.

C. Fuel removal.

D. Temporary containment of excavated soil.

E. Testing soils for contamination.

F. Disposal of contaminated soil.

G. Backfilling.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Dewatering of excavations and water control.

B. Section 02 4100 - Demolition.

C. Section 31 2200 - Grading: Soil removal from surface of site.

D. Section 31 2323 - Fill: Fill materials, filling, and compacting.

1.03 REFERENCE STANDARDS

A. API RP 1604 - Closure of Underground Petroleum Storage Tanks; 1996 (R2010).

B. 29 CFR 1910.38 - Emergency action plans; current edition.

C. EPA SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; Current Edition.

D. EPA 600-4-790-20 - Methods for Chemical Analysis of Water and Wastes; 1983.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with local, state, and federal regulations and 40 CFR 280.

B. Qualifications: Prior to start of work, submit documentation of recent experience and resumes of personnel working on the project.

C. References: Furnish data proving experience on at least three prior projects that included types of activities similar to those in this project. Provide project titles, dates of projects, owners of projects, point of contact for each project, and phone numbers of each point of contact.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION FOR TANK REMOVAL AND DISPOSAL

A. Site Safety And Health Plan (SSHP): Furnish safety, health, and accident prevention provisions and develop a Site Safety and Health Plan (SSHP).

B. Personnel Protection: Furnish appropriate personal safety equipment and protective clothing to personnel.
   1. Ensure that safety equipment and protective clothing is kept clean and well maintained.

C. Decontamination: Decontaminate or properly dispose of personal protective equipment and clothing worn in contaminated areas at the end of the work day.

D. First Aid And Emergency Response Equipment And Procedures: Provide appropriate emergency first aid equipment for treatment of exposure to site physical and chemical hazards.

1. Provide and post a list of emergency phone numbers and points of contact for fire, hospital, police, ambulance, and other necessary contacts.
2. Provide and post a route map detailing the directions to the nearest medical facility.

E. Ignition Sources: Do not permit ignition sources in the EZ and CRZ.

F. Waste Disposal: The SSHP shall detail the practices and procedures to be utilized to dispose of wastes. Upon completion of the project, certify that equipment and materials were properly decontaminated prior to being removed from the site.

G. Emergency Response Requirements: Furnish emergency response and contingency plan in accordance with 29 CFR 1910.38.
1. In an emergency, take action to remove or minimize the cause of the emergency, alert the Architect, and institute necessary measures to prevent repetition of the emergency.
2. Equip site-support vehicles with route maps providing directions to the medical treatment facility.

H. Unforeseen Hazards: Notify the Architect of any unforeseen hazard or condition that becomes evident during work.

3.02 TANK CLEANING

A. Provide clean and vapor free tank in accordance with API RP 1604.

B. Fuel Removal:
1. All possible fuel will be pumped or otherwise removed from the tank by Contractor.
2. Dispose of remaining fuel emulsions in accordance with applicable local, state, and federal regulations.

3.03 TEMPORARY CONTAINMENT OF EXCAVATED SOIL

A. Provide temporary containment area near the excavated area.

3.04 EXCAVATION

A. Provide Architect with written documentation, no later than 30 days before work begins, that proper state or local authorities have been notified.

B. Notify Architect at least 48 hours prior to start of tank removal work.
1. Stage operations to minimize the time that tank excavation is open and the time that contaminated soil is exposed to the weather.
2. Provide protection measures around the excavation area to prevent water runoff and to contain the soil within the excavation area.

C. Excavation: Excavate as required to remove tanks and piping.
1. Place soil removed from the excavation in a temporary containment area.
2. Collect and temporarily store water runoff from stockpiled soils.

D. Excavation Methods: Select methods and equipment to remove soil to minimize disturbance to areas beyond the limits of the excavation area.
1. Material that becomes contaminated as a result of Contractor's operations shall be removed and disposed of at no additional cost to Owner.
2. Where excavation extends into groundwater levels, dewatering methods shall be employed on a localized basis to facilitate excavation operations, as specified in Section 01 7000.

3.05 TESTING

A. Stockpiled Soils: Soils with OVA/FID readings of 10 ppm or greater shall be further sampled and tested.
1. Test for TPH and for BTEX in accordance with EPA SW-846 and EPA 600-4-790-20.
2. Test for toxicity characteristic leaching procedure (TCLP) for lead if leaded gasoline was stored in or near the underground tank being removed.
3. For TPH, provide a minimum of one test for every 100 cubic yards (77 cubic meters).
4. For BTEX and TCLP, provide one test for every 100 cubic yards (77 cubic meters).

5. Soils that contain 50 ppm or more TPH, 10 ppm or more BTEX or have TCLP reading of 10 ppm lead or virgin petroleum products are considered contaminated materials.
6. Soils that test at levels less than the above may be used as clean fill.
7. Furnish results to Architect within 24 hours after the results are obtained.

3.06 DISPOSAL OF UNDERGROUND TANKS, ANCHORS, SLABS, AND ASSOCIATED PIPING

A. Preparation: API RP 1604. Remove the fill pipe, gauge pipe, vapor recovery truck connection, submersible pumps, and drop tube.
   1. Cap or remove non-product piping, except vent piping.
   2. Plug tank openings so that vapors will exit through vent piping during the vapor-freeing process.

B. Purging: Remove flammable vapors in accordance with API RP 1604. Tanks shall be certified as "vapor free" prior to further work.

C. Cleaning and Testing: Clean tank and perform atmosphere testing in accordance with API RP 1604.
   1. Distribution (product delivery) piping shall be cleaned and removed or the piping shall be cleaned, filled with concrete, and abandoned in place.
   2. Test the tank atmosphere and the excavation area for flammable or combustible vapor concentrations, with a combustible gas indicator until the tank is removed from the excavation and from the site.

D. Tank Removal and Disposal:
   1. Plug or cap accessible holes. One plug shall have a minimum 1/8 inch (3 mm) vent hole.
   2. Remove tank from the excavation, place it on a level surface and render it useless in accordance with API RP 1604.
   3. Provide warning labels on tank if tank contained leaded fuels, as follows:
      a. "TANK HAS CONTAINED #2 Heating Oil -- NOT VAPOR FREE -- NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS INTENDED FOR HUMAN OR ANIMAL CONSUMPTION -- DATE OF REMOVAL: MONTH/DAY/YEAR"
   4. Transport and dispose of tank at an EPA approved disposal site in accordance with federal, state, and local regulations.

3.07 CLOSURE REPORT (SITE ASSESSMENT REPORT)

A. Provide Architect a Site Assessment Report in a single binder notebook that contains the full collection of reports relating to this work, including but not limited to, records, starting and ending dates of reporting period, inspections, documentation, and data as follows:
   1. Complete UST Notification Form (within 30 days of closure).
   2. Description of work, including removal procedures, number of tanks removed, identification of tanks removed and disposed of, cubic yards of excavated soil, location of disposal sites, and dates of excavation.
   3. Site plan, including location of tanks and piping, limits of excavation, sampling points, results of excavation, and depths.
   4. Laboratory testing reports, copies of data and test results from testing laboratory.
   5. Tank disposal paperwork, contaminated soil disposal paperwork, and contaminated water disposal paperwork.
   6. Certifications required by implementing agency.
   7. Building permit, inspection permits, and other permits required for underground tank removal, notifications, and inspection reports.
   8. Cumulative quantities of soil excavated, beginning with start date for each tank and associated piping.

3.08 SPILLS OF CONTAMINATED SOILS

A. Use appropriate vehicles and operating practices to prevent spillage or leakage of contaminated materials from occurring during operations. Inspect vehicles leaving the area of contamination to ensure that no contaminated materials adhere to the wheels or undercarriage.

3.09 BACKFILLING

A. Provide backfill, compaction, grading, and seeding in accordance with 31 2323.

END OF SECTION

SECTION 03 2100
REINFORCING STEEL

PART 1 GENERAL

1.1 DESCRIPTION:

A. Under this Section, the Contractor shall furnish all labor, materials and equipment for installing all Reinforcing Steel, welded wire fabric and accessories for cast-in-place concrete as shown on the Plans, as specified, and/or directed.

1.2 REFERENCES:

A. Reference to standard specifications for the following organizations is intended to specify minimum standards for quality of materials and performance of workmanship, and for standard test methods.

1. American Society for Testing and Materials (ASTM) Publications, Latest Edition.
2. American Concrete Institute (ACI) Standards, Latest Edition.
3. American Welding Society (AWS) Publications, Latest Edition.
4. American National Standards Institute (ANSI) Publications, Latest Edition.
5. Concrete Reinforcing Steel Institute (CRSI) Publications, Latest Edition.

1.3 SUBMITTALS:

A. Shop Drawings: Indicate bar sizes, spacings, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices. No work on fabricating or placing steel shall be done until such drawings and schedules have been approved.

B. Manufacturer's Certificate: Submit certified copies of mill test report of reinforcement materials analysis.

C. Welder's Certificate: Submit certification from welders employed on the work, verifying AWS qualification within the previous twelve months.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Reinforcing steel bars shall be free from defects, kinks, bends, rust, scale or other irregularities. Reinforcing mesh shall be of the electrically welded type, with wires arranged in rectangular or square patterns.

B. Reinforcing bars shall be deformed billet steel meeting the requirements of ASTM A615 Grade 60.

C. Steel wire fabric shall meet the requirements of ASTM A185.

D. 2.1.4 Stirrup steel shall be cold drawn steel wire meeting the requirements of ASTM A82.

E. 2.1.5 Epoxy coated reinforcing bars shall be deformed billet steel meeting the requirements of ASTM A775, Grade 60.

F. 2.1.6 Galvanized reinforcing bars shall be deformed billet steel meeting the requirements of ASTM A767, Grade 60.

G. 2.1.7 Accessory materials shall include: tie wire, minimum 16 gage annealed type. Epoxy-coated reinforcing bars shall be tied with plastic-; epoxy-; or nylon-coated tie wire. Chairs, bolsters, bar supports, and spacers shall be sized and shaped for strength and support of reinforcement during concrete placement conditions.

2.2 IDENTIFICATION AND PROTECTION OF BARS AND FABRIC:

A. Reinforcing steel shall be delivered to the work in strongly tied bundles identified with metal tags corresponding to the bar schedules and diagrams. Identification marks shall show quantity, producing mill, bar size, type of steel and grade mark.

B. All bars and fabric shall be stored off the ground and shall, at all times, be protected from moisture and be kept free from dirt, oil, or injurious coatings. Epoxy-coated reinforcing bars shall be stored on protective cribbing. If concreting is delayed for any considerable number of days after the reinforcing is placed in position, it shall be protected by covering with canvas or other satisfactory covering, or, if directed, shall be painted with a coat of neat cement grout.

C. Any bar or fabric having a scaly rust shall be cleaned. Epoxy-coated reinforcing bars that are cut, welded or otherwise damaged shall be repaired with patching material conforming to ASTM A775 and done in accordance with the Material Manufacturer's recommendation. Galvanized reinforcing bars that are cut, welded or otherwise damaged shall be repaired with patching material conforming to ASTM A767 and done in accordance with the Material Manufacturer's recommendation. The Contractor will be required to replace bars exhibiting severely damaged coatings.

PART 3 EXECUTION

3.1 FABRICATION AND INSTALLATION:

A. Metal reinforcing shall be properly fabricated in accordance to references specified.

B. Metal reinforcing shall be properly placed in accordance to CRSI, ACI 301, ACI 318, ACI SP-66, as shown on the approved Shop Drawings and as herein directed.

C. Bars shall be bent in the shop to the shapes shown or required. Field bending shall be done only with the written approval of the Engineer. Field welding shall not be allowed without direct approval and supervision of the Engineer.

D. Unless otherwise shown, splices in tension reinforcement shall not be permitted, and splices in compression reinforcement shall be lapped 40 diameters. All bar splices shall be staggered, wherever possible. Locate splices not indicated on drawings, at point of minimum stress. Splice locations must be approved by the Engineer.

E. Reinforcing shall be securely tied and supported and must not be displaced during concrete placing operations. Epoxy-coated reinforcing bars shall rest on coated wire bar supports, or other acceptable materials. Dowels must be wired in place before concreting begins. All metal shall be kept away from exposed surfaces of concrete.

F. Conduit in slabs on grade shall be placed in a depression below the slab and the mesh run continuous over conduit. Conduit in slabs on forms shall be above the bottom reinforcing and below the top reinforcing. No conduit is permitted in thin joist slabs.

G. Cutting of bars to clear openings in walls or slabs is strictly prohibited. Warp bars around such openings.

H. Provide two #6 diagonal bars at each corner of every rectangular opening in walls, unless otherwise shown on the Plans.

I. All slabs, unless otherwise shown on the Plans, to be reinforced with not less than WWF 6 x 6 - W2.9 x W2.9 welded wire mesh.

J. Placing of concrete shall not be scheduled until all of the reinforcing for the section is secured in place and the reinforcing and forms have been approved by the Engineer or his representative. Contractor shall notify the Engineer 24 hours prior to a concrete pour.

K. Welded wire mesh in slabs is to be placed in the upper third of the depth of the slab. Lap 6" minimum. Fabric shall be straightened as required before placement.

L. Provide bent bars 6'-0" long of same size and spacing as horizontal bars for all corners of foundation walls, unless otherwise shown on the Plans.

M. Do not displace or damage vapor barrier.

N. For footing reinforcement - support bars on small precast concrete blocks; space at intervals as shown on the Plans and within minimum height specified above underside of slab or footing.

O. Reinforcement shall not be bent after being partially embedded in hardened concrete.

3.2 CONCRETE PROTECTION FOR REINFORCEMENT:

A. Unless otherwise shown or directed, concrete protection, measured from the surface of the bar, shall be the following:

B. For concrete deposited against the ground, without the use of forms... 3 inches

C. For formed concrete in contact with the ground..... 2 inches

D. For slabs and walls contacting water or sewage..... 2 inches

E. For slabs and walls contacting water or sewage..... 2 inches

F. For beams, girders and columns not directly exposed to ground and weather..... 1-1/2 inches

G. For beams, girders and columns not directly exposed to ground and weather ..... 1-1/2 inches

H. For formed concrete exposed to the weather ..... 2 inches

I. For slabs and walls, not directly exposed to ground, weather, water or sewage.....1 inch

J. Exposed reinforcing bars intended for bonding with future extensions shall be protected from corrosion by a covering of concrete or other approved material.

++END OF SECTION++

SECTION 03 3000
CAST-IN-PLACE-CONCRETE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Floors and slabs on grade.

B. Concrete foundation walls, footings, and piers.

C. Fiber reinforcement

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads, conctete for steel bollards, and flagpole bases.

F. Waterstops.

G. Concrete curing.

H. Stairs and ramps.

I. Stair nosing.

J. Retaining wall.

K. Pits.

L. Fence posts.

M. Finishes.

N. Mix design.

O. Waterproof concrete admixture.

P. Vapor Retarder.

Q. Concrete materials.

R. Placement procedure.

S. Field Quality Control.

1.3 RELATED REQUIREMENTS

A. Section 01 45 33 - Code-Required Special Inspections.

B. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

C. Section 03 20 00 - Concrete Reinforcing.

D. Section 03 35 33 - Stamped Concrete Finishing: Additional requirements for patterned concrete surfaces.

E. Saection 03 41 00 - Precast Structural Concrete.

F. Section 07 11 13 - Bituminous Dampproofing

G. Section 07 13 00 - Sheet Waterproofing.

H. Section 07 18 00 - Traffic Coatings.

I. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

J. Section 10 21 15 - Plastic Shower Cubicals: For recess required for terrazzo shower base.

K. Section 32 13 13 - Concrete Paving: Sidewalks, curbs and gutters.

L. Section 31 23 16 - Excavation for drainage fill under slab-on grade, stairs, ramps, and retaining walls..

M. Section 33 46 00 - Subdrainage for underground foundation drainage systems.

1.4 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; 1998 (Reapproved 2004).

C. ACI 301 - Specifications for Structural Concrete; 2016.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

E. ACI 303 "Guide to Cast-in-Place Architectural Concrete Practice."

F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

G. ACI 305R - Guide to Hot Weather Concreting; 2010.

H. ACI 306R - Guide to Cold Weather Concreting; 2016.

I. ACI 308R - Guide to External Curing of Concrete; 2016.

J. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

K. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).

M. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.

N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2018.

O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.

Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2017.

U. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.

V. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014a.

W. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).

X. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

Y. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 2014.

Z. COE CRD-C 513 - COE Specifications for Rubber Waterstops; 1974.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions for each product indicated.

C. Mix Design: Submit proposed concrete mix design with NY State PE seal and signature.

1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

3. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Samples: Submit two, 6 inch long samples of waterstops.

F. Test Reports: Submit report for each test or series of tests specified.

G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

H. Qualification Data: For installer, testing agency, and concrete supplier.

I. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Material Certificates: For each of the following, signed by manufacturers:

a. Cementitious materials.

b. Admixtures.

c. Form materials and form-release agents.

d. Steel reinforcement and accessories.

e. Waterstops.

f. Curing compounds.

g. Bonding agents.

h. Semirigid joint filler.

i. Joint-filler strips.

j. Repair materials.

J. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.6 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Manufacturer/Supplier Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

E. Installer Qualifications: The work of this section shall be performed by a qualified installer, with a minimum of five (5) years experience, approved by the Owner's Representative. The term “installer”

used herein, shall mean a firm of established reputation which is regularly engaged in and which maintains a regular force of workmen skilled in the installation of the type of work specified in this section.

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

G. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements.-

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.

b. Independent testing agency responsible for concrete design mixtures.

c. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

J. Delivery Records: Each delivery to the site of concrete shall be accompanied by weigh master's certification. Retain all copies for inspection by the Testing Agency.

1. Indicate water added to mix a job site on each delivery ticket. Show quantity of water added. Site water tempered mixes exceeding specified slump range will be rejected as not complying with specification requirements

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials so as to preserve their quality and fitness for work.

B. Store reinforcement and formwork in manner to prevent bending, damage (including damage to coatings), and accumulation of dirt.

C. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

D. All packed materials shall be delivered to the site in original unopened containers, clearly indicating manufacturer's name, brand name, and other identifying information.

1.9 PROJECT CONDITIONS

A. Coordinate with the work of all other sections and/or separate contracts.

PART 2 PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 10 00.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

2.2 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

1. Acquire aggregates for entire project from same source.

2. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps, or other deleterious substances.

3. Coarse Aggregate: Clean, uncoated, processed aggregate free from clay, mud, loam, or foreign matter.

4. Gradations:

a. For footings, foundation walls, piers, grade beams, basement walls, retaining walls, and interior walls:

	Sieve Size	Percent Passing
b)	2 inch	100
c)	1-1/2 inch	95 to 100
d)	3/4 inch	35 to 70
e)	3/8 inch	10 to 30
f)		0 to 5

b. For Slabs on Grade:

a)	Sieve Size	Percent Passing
b)	1 inch	95 to 98.5
c)	3/4 inch	75 to 94
d)	1/2 inch	25 to 50
e)	3/8 inch	10 to 25
f)	0 to 10	

c. For Slabs on Metal Deck:

a)	Sieve Size	Percent Passing
b)	1 inch	95 to 100
c)	3/4 inch	82 to 94
d)	1/2 inch	40 to 68
e)	3/8 inch	20 to 44
f)	0 to 10	

d. For other applications:

a)	Sieve Size	Percent Passing
b)	1-1/2 inch	100
c)	1 inch	95 to 100
d)	1/2 inch	25 to 60
e)	0 to 10	
f)	0 to 5	

C. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

D. Structural Fiber Reinforcement: ASTM C1116/C1116M.

1. Fiber Type: Alkali-resistant synthetic.

2. Fiber Length: 0.5 inch, nominal.

3. Manufacturers:

a. Euclid Chemical Company; Fiberstrand F: www.euclidchemical.com.

b. SI Concrete Systems; Fibermesh.

c. Axim Concrete Technologies; Fibrasol F.

d. Grace Construction Products, W. R. Grace & Co.; Grace Fibers.

e. Substitutions: See Section 01 25 00 Substitution Procedures..

2.4 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. Water Reducing Admixture: ASTM C494/C494M Type A.

D. Chemical Hardener: Fluosilicate solution designed for densification of cured concrete slabs.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.

1. Installation: Comply with ASTM E1643.

2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

3. Manufacturers:

a. "Griffolyn T-65G" by Reef Industries In, three-ply, nylon- or polyester-cord-reinforced, high-density polyethylene sheet; laminated to a nonwoven geotextile fabric, 30 mils (0.76 mm) thick.

b. Substitutions: See Section 01 25 00 Substitution Procedures.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M.

2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch.

3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.

4. Products containing aluminum powder are not permitted.

C. Removable post sleeve: Plastic sleeve for forming post holes.

1. Product:"E2 Sleeve" by Sharpe Products.

D. Abrasive Stair Nosings: Consisting of an abrasive non-slip filler bonded and locked into channels in an extruded aluminum base, alloy 6063-T6. Coefficient of friction 1.02 dry, 0.98 wet per ASTM F 609. Provide the following:

1. Tread Cast aluminum solid surface tread plate 5/16 inch thick with continuous wing anchor 1-1/4 inches deep.

    a. 4 inches wide, lip 1/4 inch from underside.

2. Space anchors 3" from ends .

3. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete

4. Product:

    a. American Safety Tread, Style 801 "alumacast" (cast aluminum). PO Box 611, Helena, AL 35080.

    b. Substitutions: See Section 01 25 00 Substitution Procedures..

2.6 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.

2. Manufacturers:

    a. Euclid Chemical Company: www.euclidchemical.com.

    b. Dayton Superior Corporation: www.daytonsuperior.com.

    c. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

    d. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

    e. Substitutions: See Section 01 25 00 Substitution Procedures..

B. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.

C. Waterstops: PVC, complying with COE CRD-C 572.

1. Configuration: As indicated on drawings.

2. Size: As indicated on drawings.

3. Manufacturers:

a. Sealtight PVC Waterstop 6380" by W.R. Meadows.

b. Wirestop FD-6380" by Paul Murphy Plastics Company.

c. Substitutions: See Section 01 25 00 Substitution Procedures..

D. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.

1. Thickness: 0.022-inch-thick (26-gauge) galvanized sheet steel.

2. Size: As indicated on drawings.

3. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

F. Slab Isolation Joint Filler: 1/4 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

2. Manufacturers:

a. W. R. Meadows, Inc; Fiber Expansion Joint Filler with Snap-Cap: www.wrmeadows.com.

b. Substitutions: See Section 01 25 00 Substitution Procedures.

G. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.

2. Height: To suit slab thickness.

3. Manufacturers:

a. Vinylex, Knoxville, TN 37921 (615) 690-2211.

b. Substitutions: See Section 01 25 00 Substitution Procedures..

2.7 GRAFFITI PROTECTION

A. Graffiti Protection: ProSoCo Sure Klean Blok-Guard & Graffiti Control II

1. Application: Graffiti protection all surfaces.

2.8 CURING MATERIALS

A. Moisture-Retaining Sheet: ASTM C171.

1. Polyethylene film, clear, minimum nominal thickness of 4 mil, 0.004 inch.

B. Membrane Curing Compound: ASTM C 309 Type 1 - Clear or translucent, Class A.

C. Water: Potable, not detrimental to concrete.

2.9 CONCRETE MIX DESIGN

A. Proportioning Normal and Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to for preparing and reporting proposed mix designs.

a. here concrete production facility can establish uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed specified design strength by requirements of ACI 318, Section 5.3.2.1 or ACI 301, Section 3.9.

2. Compressive Strength: Not less than 4,000 at 28 days when tested according to ASTM C 109/C 109M.

C. Identify sources of all products used in design mixes.

D. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

E. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions. Slabs on grade only.

F. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.

2. Water-Cement Ratio: Maximum 0.45.

3. Total Air Content: 6 percent, determined in accordance with ASTM C173/C173M.

4. Maximum Slump: 4 inches.

G. Pumping of concrete is permitted only if mix designs specifically prepared and used previously for pumping are submitted. Mix designs not previously used for anticipated pump line lengths shall be tested by Contractor to verify suitability for project before use at site. Pump line shall have 5-inch-minimum inside diameter and be used with 5-inch pumps

2.10 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

2.11 FINISHES

A. "Rapid Set WunderFixx" as manufactured by CTS Cement Manufacturing Corporation, www.ctscement.com <http://www.ctscement.com> or approved equal.

1. Use for finishing all exposed concrete vertical surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Clean and coat forms before erection. Do not coat forms in place.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Chamfer exposed corners and edges as indicated using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

E. Fit corners and joints with gaskets or tape to prevent leakage.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Sleeves: Provide sleeves in concrete formwork for plumbing, electrical, and mechanical penetrations. Coordinate size and location of sleeves with Contractors and mechanical, electrical, and plumbing drawings.

1. Accurately place and secure in forms.

2. Coordinate sleeve locations with reinforcing bars.

H. Penetrations shall not occur through footings, piers, columns, beams, joists, grade beams, or supported slabs unless shown in structural drawings

I. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

J. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture

slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

K. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

L. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

M. Seal vapor retarder to walls and penetrations with manufacturer-recommended mastic to form continuous barrier.

N. Seal vapor retarder to walls and penetrations with manufacturer-recommended mastic to form continuous barrier.

3.3 WATERSTOPS

A. Flexible Waterstops: Install in construction joints, all joints between foundation walls and footing or slab and as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

3.4 WATERPROOF MORTAR

A. Install as per manufacturer's instructions.

1. Apply at all junctions of slab on grade and vertical foundation walls.

3.5 WATERPROOF ADMIXTURE

A. Verify that site conditions are acceptable for placement of waterproofed concrete.

B. Comply with the Waterproof Concrete Admixture Manufacturer’s instructions and recommendations.

C. Waterstops: Install in accordance with Waterproof Concrete Admixture Manufacturer’s recommendations.

3.6 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Owner's Representative not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, waterstops, and formed construction joint devices will not be disturbed during concrete placement.

F. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight

G. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

1. Slabs on Grade: Use strip pour methods and mechanical vibratory screed whenever possible.

2. Deposit and consolidate concrete in continuous operation within limits of construction joints until placing of panel or section is complete.

3. Consolidate concrete during placing operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

4. Bring slab surfaces to correct level with a straightedge and strike off. Uniformly slope to drains. Use darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water or portland cement on plastic surface. Do not disturb slab surfaces before beginning finishing operations.

5. For floor areas with drains, Contractor shall be responsible for finishing concrete slabs to proper elevations to ensure surface moisture will drain freely to floor drains and no puddle areas exist. Reference elevations shown in drawings.

H. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

I. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

J. Do not use vibrators to transport concrete inside formwork.

K. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Vibrators shall penetrate placed layer of concrete at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set.

L. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

M. Do not allow vibrator to come in contact with form.

3.7 FINISHES

A. "Rapid Set WunderFixx" as manufactured by CTS Cement Manufacturing Corporation, www.ctscement.com <http://www.ctscement.com> or approved equal.

1. Use for finishing all exposed concrete vertical surfaces.

3.8 SLAB JOINTING

A. Locate joints as indicated on drawings or as recommended by ACI 302.

B. For placement of slabs that will be subsequently concealed with an architectural finish material place slabs with few construction joints or as recommended by ACI 302.

C. Anchor joint fillers and devices to prevent movement during concrete placement .

D. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

2. Place joint filler in floor slab pattern placement sequence. Set top to required elevations.

3. Install joint devices in accordance with manufacturer's instructions.

4. Apply sealants in joint devices in accordance with Section 07 92 00 - Joint Sealants.

E. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

F. Hand tooled or Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.9 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:

1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.

B. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

C. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Equipment Bases and Foundations: Provide machine, locker and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

C. Stair Nosing: Examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work

1. Strictly comply with manufacturer's instructions and recommendations and approved details. Securely anchor work to substrate.

2. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired

3.11 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Preparation:

a. Mechanically remove loose, unsound, contaminated concrete.

b. Concrete must be free of materials such as paint, oil, curing compound, bond breaker, etc. that will inhibit bonding.

c. Thoroughly clean extraneous material such as dirt, loose chips, and dust from concrete surface. If compressed air is used, it shall be free of oil.

d. Concrete surface shall be dry

2. Mixing:

a. Use 1 part water to 2 parts of material.

b. Mixed material should have a temperature of about 70°F. Warmer material will set faster than expected and cooler material will have slower strength gain. Control the mixed temperature by protecting the bags of repair material from temperature extremes and adjust the mixed temperature by using hot or cold water.

c. Add potable water first then add material while mixing mechanically with a drill and mixing paddle.

d. Do NOT add any other admixtures. Do NOT add sand, aggregate, or cement.

e. Mix until smooth, uniform, and lump-free (usually 3 to 5 minutes).

f. Do NOT re-temper.

g. Clean mixing bucket and tools between batches.

3. Placement:

a. Place material onto the dry substrate.

b. Maintain surface and ambient temperature between 45°F and 100°F during and for 4 hours after placement.

c. Protect adjacent surfaces with drop cloths, waterproof paper, or other means to maintain them free of material splashes, water, and debris.

d. Place material immediately after mixing.

e. Apply material in one pass and avoid re-troweling.

f. As the material becomes stiff (usually 10 to 20 minutes) use a trowel to shave or cut the material to the desired shape.

g. Sanding may be begun as soon as material has dried and must be completed within 24 hours.

4. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

E. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:

1. Broom Finish: Apply a broom finish to exterior sidewalks, concrete platforms, steps, and ramps, and elsewhere as indicated.

a. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

2. Surfaces to Be Left Exposed: Steel Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

a. Chemical Hardener: After slab has cured, apply water-diluted hardener in three coats per manufacturer's instructions, allowing 24 hours between coats.

3. Screed floors level, maintaining the following minimum F(F) Floor Flatness and F(L) Floor Levelness values when measured in accordance with ASTM E 1155/ASTM E 1155M.

a. F(F): Specified Overall Value (SOV) of 35; Minimum Localized Value (MLV) of 24.

F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.12 GRAFFITI PROTECTION

A. Preparation: Protect people, vehicles, property, plants, windows and all non-masonry surfaces from product, splash, residue, fumes and wind drift. Protect and/ or divert foot and auto traffic.

1. Surface should be clean, dry and absorbent. If cleaning is necessary, use the appropriate cleaner recommended by the manufacturer.

2. Newly constructed surfaces and re-pointed surfaces shall cure for 28 days before application.

3. Sealant and caulking compounds shall be in place and cured before application.

4. Surface and air temperatures are to be 40-95°F (4-35°C) during use and for 8 hours after.

B. Application: Test each surface for suitability and desired results before overall application.

1. Apply “wet-on-wet” to a visibly dry and absorbent surface.

2. Spray Application: Saturate from the bottom up. Let the first application penetrate for 2-3 minutes. Re-saturate.

3. For porous surfaces apply a second wet-on-wet coat as soon as the first application is dry to the touch or within one hour.

C. Provide graffiti protection on all exposed vertical concrete walls.

3.13 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by saturated burlap.

a. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3. Final Curing: Begin after initial curing but before surface is dry.

a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

3.14 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

G. Permeability Test: Test concrete with waterproofing admixture according to COE CRD-C 48.

H. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.15 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Owner's Representative and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Owner's Representative. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Owner's Representative for each individual area.

3.16 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

SECTION 03 3001
SITE CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 DESCRIPTION:

A. Under this Section, the Contractor shall furnish all labor, materials and equipment for plain and reinforced Cast-In-Place Concrete work including accessory items of work herein described, as shown on the Plans, as specified, and/or directed.

1.2 REFERENCES:

A. Reference to standard specifications for the following organizations is intended to specify minimum standards for quality of materials and performance of workmanship, and for standard test methods.
   1. American Society for Testing and Materials (ASTM) Publications, Latest Edition.
   2. American Concrete Institute (ACI) Standards, Latest Edition.
   3. Standard Specifications - Construction and Materials, New York State Department of Transportation (NYSDOT), Latest Edition, including Addenda thereto.

1.3 QUALITY ASSURANCE:

A. Perform work in accordance with ACI 301 and ACI 302.

B. Acquire cement and aggregate from same source for all work.

C. Conform to ACI 305R when concreting during hot weather, except as herein modified.

D. Conform to ACI 306R when concreting during cold weather, except as herein modified.

1.4 SUBMITTALS, SAMPLES AND TESTS:

A. Product Data: Provide data on joint devices, attachment accessories and admixtures.
   1. Samples and tests of all materials to be incorporated in the concrete shall be submitted in ample time for testing before delivery. All materials are subject to inspection and testing by a commercial testing laboratory approved by the Owner's Representative at the Owner's expense. All materials are subject to approval by the Owner's Representative prior to their delivery to the site.
   2. The Contractor shall obtain from the manufacturer, prior to the actual delivery of the concrete, a statement giving the sources, specific gravities, and sieve analyses

of the aggregates and the dry weights of cement and saturated-surface-dry weights of fine and coarse aggregate and quantities, type and name of admixture (if any) and of water per cubic yard of concrete that will be used in the manufacture of each class of concrete to be provided. This data shall be sent to the Owner's Representative for review and approval.

a. Aggregates shall be tested for gradation, purity and accelerated soundness. Tests shall comply with ASTM C33, C136, ASTM C40, and ASTM C88. The source of the material shall not be changed without retesting.

b. Cement shall have representative mill test reports on physical and chemical requirements. All cement stored at job site or at concrete supplier's place for over 60 days shall be tested for compliance with ASTM C150.

c. Contractor shall submit concrete mix design to be reviewed by the Owner's Representative.

d. Tests of other materials may be required by the Owner's Representative.

PART 2 PRODUCTS

2.1 MATERIALS:

A. All materials shown, specified or required to be incorporated in cast-in-place concrete shall be of finest quality, and shall be delivered, stored and handled so as to prevent damage. Damaged or inferior materials will be rejected. Approved brands or sources must be used, without change for the entire project. All materials shall be proportioned to produce a well graded mixture of high density and maximum workability.

B. Portland Cement shall be a standard brand in compliance with ASTM C150 Type I. Only one brand shall be used for exposed work. Generally, Type I cement shall be used; however, Types II or III may be employed with the approval of the Owner's Representative or if shown, or specified.

C. Fine Aggregates shall be clean, sharp, natural sand, free from loam, clay, organic impurities or frozen materials and shall conform to ASTM C33 in all respects. Sand shall be tested for impurities in accordance with ASTM C40.

D. Coarse Aggregates shall consist of strong, clean, crushed limestone or crushed gravel, free from harmful material and meeting all of the requirements of ASTM C33. Coarse aggregate shall also comply with New York State Department of Transportation Material Designation 703-02. Crushed limestone and crushed gravel shall meet the Physical Requirements (Testing) Designation 703-0201 and 703-0202, respectively.

E. Water used in mixing concrete shall be clean and free from all acid, alkali or organic

matter and shall be obtained from a public water supply unless specifically permitted otherwise by the Owner's Representative.

F. Ready Mix Concrete shall comply with ASTM Specification C94, this Specification, and used subject to the Owner's Representative's approval.

2.1.6 Ready Mix Concrete shall comply with ASTM Specification C94, this Specification, and used subject to the Owner's Representative's approval.

2.1.7 Admixtures, where shown or specified, shall be as follows:

a. Air entraining agent shall be "Daravair" or "Darex AEA" as manufactured by W.R. Grace Co., or Master Builder's "MBVR", or equal meeting the requirements of ASTM C260.
b. Water reducing agent shall be Sika "Plastiment", Master Builder's "Pozzolith", W.R. Grace's "WRDA", or equal meeting the requirements of ASTM C494.
c. High range water reducers or superplasticizers shall be Sika "Sikament-FF", W.R. Grace's "Daracem-100" or "WRDA-19", or equal meeting the requirements of ASTM C494.

2.1.8 Bonding Agent, where shown or specified, shall be "Dural 104" bonding compound manufactured by Dural International Corporation, "Sikadur 32 Hi Mod" by Sika Corporation, or equal.

2.1.9 Anchorage Items, where shown or specified, shall be as follows:

a. Inserts for fastening shelf angles shall be malleable iron adjustable wedge type, with bolt and washer, if required, as manufactured by Hohman & Barnard, Inc., Richmond Screw Anchor Co., Inc., or equal.
b. Threaded inserts for fastening of soffits of concrete beams shall malleable iron, as manufactured by Hohman & Barnard, Inc., Richmond Screw Anchor Co., Inc., or equal.
c. Ceiling hanger inserts shall be standard type wire as manufactured by Hohman & Barnard, Inc., Heckman Building Products, Inc., or equal.
d. Masonry anchor slots shall be galvanized sheet metal, felt filled, as manufactured by Hohman & Barnard, Inc., Heckman Building Products, Inc., or equal.
e. Flashing reglets shall be O'Keefe's Inc., PVC "Watertite Type P", or equal to size and shape shown.

2.1.10 Flexible Sleeve, where shown or specified, shall be of resilient rubber with a flanged, serrated waterstop and shall be cast directly into the walls of the concrete structure as shown on the Contract Documents. Flexible sleeve shall conform to the following physical requirements:

PROPERTY	ASTM TEST REQUIREMENTS		
	METHOD	MIN.	MAX.
Tensile Strength, psi	D412	1500	-
Ultimate Elongation, percent	D412	450	-
Hardness, Type A durometer	D2240	45	55

2.1.10.1 Flexible sleeve must permit a minimum of 10 degrees deflection in all directions. Flexible sleeve shall be "Lockjoint Flexible Manhole Sleeve" as manufactured by Chardon Rubber Company, or equal.

2.1.11 Forms shall be wood, metal, or other approved materials as follows:

a. Plywood shall be Commercial Standard Douglas Fir, moisture resistant, concrete form plywood, at least 5-ply 5/8" thick.
b. Metal forms shall be as approved, and must produce surfaces equal to those specified for wood forms.
c. Form oil shall be an approved non-staining mineral oil, such as "Duogaurd II" by W.R. Meadows, or equal.
d. Form ties shall be of approved design, adjustable length and free of devices that will leave hole or depression larger than 7/8" diameter. When forms are removed no metal shall be left within 1" of finished surface.

2.1.12 Waterstops, where shown or specified, shall be minimum 3/8-inch thick across their entire section, heavy duty, serrated type manufactured from virgin polyvinyl chloride compound, "Model RB6-38H" as manufactured by Vinylex Corporation, or equal. They shall have a tensile strength of minimum 1800 psi and an elongation of minimum 200%.

2.1.12.1 Waterstops shall be open bulb type, 6-inch wide unless otherwise shown or directed by the Owner's Representative. The waterstops shall be supported during concrete placement to prevent dislodgement and to insure that the ends remain at right angles to the joint. Field joints shall be butt welded with an electric iron in accordance with the manufacturer's instructions.

2.1.12.2 Sample of the waterstops to be used shall be submitted to the Owner's Representative for approval.

2.1.13 Premolded Joint Filler, where shown or specified, shall be premolded, resilient, non-extruding type, 1/2-inch thick unless shown otherwise, full depth of concrete section as manufactured by Celotex Corporation, "Fibre Expansion Joint Filler"

by W.R. Meadows, or equal.

2.1.13.1 Sample of the premolded filler proposed to be used shall be submitted to the Owner's Representative for approval.

2.1.14 Joint Sealant, where shown or specified, shall be elastomeric polyurethane sealant material, black in unexposed locations, and grey in exposed locations, and have balanced properties of elongation recovery and tensile strength, and shall be Sonneborn "Sonolastic NP1", Sika "Sikaflex 1A", or equal.

2.1.15 Protective Covering for concrete finish slabs, where shown or specified, shall be "Orange Label Sisalkraft", Polyethylene Film as manufactured by Fortifiber Corp., or equal.

2.1.16 Non-Shrink Grout, where shown or specified, shall be premixed compound consisting of non-metallic aggregate, natural aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days; such as "Masterflow" as manufactured by Master Builders, "SikaGrout 212" as manufactured by Sika, or approved equal.

2.1.16.1 Non-Shrink grout shall be used under structural steel column baseplates and all equipment baseplates. All work shall be done in strict accordance with the manufacturer's recommendations. At the request of the Owner's Representative, the manufacturer's representative shall be called to the job site for consultation regarding detailed use of the grout.

2.1.17 Grout for fillets, channels, or other non-structural applications shall consist of one (1) part cement (Portland Cement Type 2) and three (3) parts fine aggregate (sand) with sufficient mixing water for the intended application.

2.1.18 Cementitious Coating Materials, where shown or specified, shall be "Thoroseal" with "Acryle 60" bonding agent, as manufactured by Thoro System Products, "Anchor Masonry Surfacer" as manufactured by Anti Hydro Waterproofing Company, or equal.

2.1.19 Curing Compound shall be acrylic based "Kure-N-Seal" as manufactured by Sonneborn, acrylic based "CS-309", or water based "VOCOMP-20" as manufactured by W.R. Meadows, or equal.

2.1.20 Vapor Retarder, where shown or specified, shall be "Moistop" as manufactured by Fortifiber Corp. Vapor Barrier shall be "Premoulded Membrane Vaporseal" as manufactured by
W.R. Meadows, or equal.

2.1.21 Perimeter Insulation, where shown or specified, shall be "Styrofoam Square Edge" as manufactured by the Dow Chemical Corporation, "Foamular 250" as manufactured by UC Industries, or equal.

2.1.22 Penetrating Sealer, where shown or specified, shall be two components, 50% solids penetrating epoxy sealer. The penetrating sealer shall be fully compatible with the types of form oil, curing compound and joint sealant used.

2.1.22.1 Concrete surfaces to be treated must be dry, cured for a minimum of 21 days, free from surface accumulations of dust, dirt, oil, debris, concrete curing compounds, bond breakers, or other compounds which would prevent penetration and intimate contact between the concrete surface and the penetrating sealer. Concrete surfaces require preparation per manufacturer's directions prior to sealer installation.

2.1.22.2 Penetrating sealer shall be "Spec-Seal" as manufactured by Conspec, Inc., or equal.

2.1.23 Metal Slab Joints, where shown or specified, shall be keyed type, minimum 18 gauge, galvanized steel by Heckmann Building Products, or equal.

2.1.24 Vapor Barrier: 6 mil (0.5 mm) thick clear polyethylene film type recommended for below grade application.

2.2 CONCRETE MIX DESIGN:

2.2.1 The Contractor shall submit concrete mix designs to be reviewed by the Owner's Representative. The mix designs shall be confirmed by making and testing trial mixes for each class of concrete to be incorporated in the work. All testing shall be made by an approved testing laboratory at the expense of the Contractor. Mix designs shall conform to the ACI 301, except as may be modified in the Plans and/or Specifications.

2.2.2 No job concrete shall be poured until the mix design for that concrete has been approved by the Owner's Representative. Once the mix has been approved, it shall not be changed, except when requested by the Owner's Representative, or if requested by the Contractor and approved by the Owner's Representative.

2.2.3 Ready-mixed concrete from an established company will be approved, if conforming to ASTM C94, and to this specification. All concrete shall be batched, mixed, delivered to the site, and shall conform to these requirements and be controlled in a manner to assure uniform concrete for the quality specified.

2.2.4 Water/cement ratios of all mixes shall be determined from w/c curve plotted from tests of the cement and aggregates used on the job. If necessary to increase the water content of the mix due to field conditions, sufficient cement must be added

to maintain the design water/cement ratio. Accelerating or retarding admixtures may be permitted by the Owner's Representative if requested by the Contractor to compensate for adverse weather conditions.

2.2.4.1 The various classes of concrete shall be designated as follows:

MAXIMUM PERMISSIBLE WATER-CEMENT RATIOS FOR CONCRETE (WHEN STRENGTH DATA FROM TRIAL BATCHES OR FIELD EXPERIENCE ARE NOT AVAILABLE)
Maximum permissible water-cement ratio

CLASS	MIN. 28-DAY COMPRESSIVE STRENGTH IN PSI*	NON-AIR-ENTRAINED CONCRETE		AIR-ENTRAINED CONCRETE	
		ABSOLUTE RATIO BY WEIGHT	US GAL. PER 94-LB. BAG OF CEMENT	ABSOLUTE RATIO BY WEIGHT	US GAL. PER 94-LB. BAG OF CEMENT
A	5,000	**	**	**	**
B	4,000	0.44	5.0	0.35	4.0
C	3,000	0.58	6.6	0.46	5.2
D	2,500	0.67	7.6	0.54	6.1
E	2,000	0.71	8.0	-	-

*28-day strength. With most materials, water/cement ratios shown will provide average strengths greater than indicated in Section 5.4 of ACI 318R as being required.
**For strength above 4,500 psi (non-air-entrained concrete) and 4,000 psi (air-entrained concrete)
Proportions shall be established by methods of Section 5.3 of ACI 318R.

Unless otherwise specified, all concrete shall be Class "B", non-air-entrained except exposed concrete which shall be air-entrained. When foundation walls or grade beams are exposed to weather above grade, the entire wall shall be considered exposed concrete.

2.2.4.2 Maximum size aggregates shall be used as follows unless otherwise designated by the Owner's Representative.

1-1/2"	general work
3/4"	thin sections; heavy reinforcing
3/4"	columns, beams and slabs
Over 1-1/2"	massive structures, with approval
3/8"	floor toppings

2.2.4.3 Slump - Maximum:

Reinforced concrete - general	4"
Reinforced concrete - thin walls, columns	5"
Non-reinforced concrete	3"
Pavements, including sidewalks	3"
Heavy mass concrete	3"

2.2.4.4 Air Content: Use an approved air entraining admixture. The entrained content shall be controlled between 4% - 6%. See Plans for concrete work requiring air entrainment.

2.2.4.4.1 For mixes containing coarse aggregate with a top size of 3/4" or smaller and for exposed concrete subject to frost and salt action, air contents shall be increased to the range of 5% - 7%.

2.2.4.5 Should the Contractor feel it advantageous to employ concrete additives to improve workmanship or facilitate his work, he shall obtain the approval of the Owner's Representative prior to his use of additives.

2.2.4.6 Use of accelerating admixtures in cold weather will not relax cold weather placement requirements.

2.3 STORAGE OF MATERIALS:

2.3.1 Portland Cement shall be stored in a weather-tight structure. No cement that has taken a warehouse set shall be used and any stored over sixty (60) days shall be rejected unless tested for soundness and setting time under ASTM C150. Such tests shall be at the Contractor's expense.

2.3.2 Fine and coarse aggregates shall be kept separated and free from deleterious substances. All topsoil shall be removed from the storage area. Materials shall be stockpiled in layers to prevent segregation; however, re-mixing may be required if gradation is not maintained. Care shall be taken not to inter-mix materials in the area with the aggregates.

2.3.3 Any materials that have deteriorated or become contaminated will be rejected for use in the concrete and must be promptly disposed of by the Contractor.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL:

3.1.1 Before each pour, forms and reinforcing shall be inspected and approved by the Owner's Representative. The Contractor shall give at least 24 hours notice before such an inspection is required. No pour shall be started until the Owner's Representative has given approval. No concreting may be done in the absence of the Owner's Representative without written permission of the Owner's Representative.

3.1.2 Concrete Batch Ticket:

3.1.2.1 The Contractor shall require the manufacturer of the concrete to furnish to the Owner's Representative with each batch of concrete before unloading at the site, a delivery ticket on which is printed, stamped, or written, information concerning said concrete as follows:

- Name of ready-mix batch plant
- Serial number of ticket
- Date
- Truck number
- Name of purchaser
- Specific designation of job (name and location)
- Designation of the concrete by compressive strength
- Amount of concrete in cubic yards
- Time loaded or of first mixing of cement and aggregates
- Reading of revolution counter at the first addition of water
- Type and brand, and amount of cement
- Type and brand, and amount of admixtures
- Total water added by producer (and W/C ratio)
- Water added at job site (upon approval of the Owner's Representative)
- Maximum size of aggregate
- Weights of fine and coarse aggregate
- Ingredients certified as being previously approved
- Signature or initials of ready-mix representative

3.1.3 Concrete Testing:

3.1.3.1 The Owner shall employ an approved commercial testing laboratory at its own expense to provide field sampling, testing and inspection of all concrete. Continuous inspection by the approved testing laboratory shall be provided during all concrete pours. The Contractor shall maintain a record set of plans at the site showing date and amount of each pour, test results and temperature. If any portion of the work shows low test results, the Owner's Representative may require batch plant inspection, additional testing, load tests, cored samples, and/or replacement of the faulty work, etc., at the Contractor's expense.

3.1.3.2 The Owner, through its approved testing laboratory, shall make all laboratory or field tests as required and shall furnish all necessary equipment. The Owner, through its approved testing laboratory, shall transport all test cylinders from the site to the laboratory.

3.1.3.3 Field concrete inspection: The Owner, through its approved testing laboratory, shall provide a competent field concrete inspector whose minimum duties shall be as follows:

- Check each truck on arrival to make sure that the concrete is not retempered.

- Make necessary slump tests for uniformity control.
- Make air tests and yield tests as required.
- Make any and all test cylinders as may be required in the Specifications.
- Notify the Owner's Representative if any test results vary from the specified limits.

3.1.3.4 Tests:

a. Concrete shall be tested by an approved testing laboratory as follows:
   - Standard 6" x 12" compression cylinders shall be in compliance with ASTM C39 in sets of four and shall be moist cured. Break 2 at 7 days, and 2 at 28 days. One set shall be made for approval of each mix design, one set for first pour of 50 cubic yards or less, and one set for each additional pour of 50 cubic yards. If less than 50 cubic yards are placed in one day, one set shall be made for each day's pour.

   - All test cylinders shall be cast, moist cured and broken under laboratory conditions in accordance with the ASTM C31 and ASTM C39. All four cylinders of a test shall be taken from the middle third of a single load. Each cylinder shall be properly labeled with an identifying mark, the mix proportions, air content, amount of water, slump, and the location in the structure where the concrete was placed. Test reports shall include all this information. Distribute copies of reports as requested by the Owner's Representative. Should any results be questionable, the Owner's Representative shall be notified immediately so that corrective measures can be taken. Any test cylinder which has broken and fails to meet requirements shall be preserved for inspection by the Owner's Representative.

3.1.4 Records:

3.1.4.1 Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.2 BATCHING AND MIXING:

3.2.1 All Batching and Mixing shall conform to the following and the ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

3.2.2 Aggregates and bulk cement shall be measured to within 1% by weight. Cement in standard sacks need not be weighed. Water shall be measured by volume or by weight to within 1/2%. Aggregate weights shall be corrected for moisture content. Admixtures shall be added through appropriate dispensing equipment to an accuracy of 3%.

3.2.3 The complete plant assembly shall be approved by the Owner's Representative and shall conform to the following requirements:

- Provide ready adjustment of aggregate weights for varying moisture contents.

- Provide means of accurately controlling and easily checking water-cement ratio.
- Provide accurate control of all materials with positive shut-off.
- Facilities shall be provided for prompt removal of excess materials in hoppers.
- Each specified size of aggregate shall be measured separately with a separate beam scale.
- Bulk cement shall be dropped through canvas drop chutes or telescopic flexible hose tremie.

3.2.4 Concrete mixers or mixer trucks shall not be loaded to more than the rated capacity of the truck.

3.2.5 All concrete shall be mixed not less than 60 revolutions in the drum of a modern power mixer, at the rated speed of rotation. Mix not less than an additional 30 revolutions after the addition of any further water to the mix.

3.2.6 Do not add raw materials to the drum until all of the preceding batch has been discharged. For transit mixers, the wash water shall be discharged and not used as part of the mix water for the next batch.

3.2.7 Transit-mixed concrete shall be transported to the job site unmixed and only after arrival at the job site shall mixing begin. All concrete shall be unloaded from the mixer within 45 minutes after completion of mixing. All concrete still remaining in the truck shall be rejected.

3.2.8 The total time interval from the time the cement makes contact with the aggregate to the complete unloading from the mixer shall not exceed 90 minutes, unless such time is extended by the Owner's Representative. The time may be reduced in hot weather or under unusual conditions, if unsatisfactory results are obtained.

3.3 FORMWORK:

3.3.1 The Contractor shall design and construct suitable and adequate formwork in conformance with ACI 347R. All shoring shall be properly braced to safely withstand all vertical, moving and lateral forces during the construction period. Responsibility for adequacy and safety rests with the Contractor. Materials shall be as stated in Paragraph 2.1.

3.3.2 General requirements for all forms shall be as follows:

- Forms shall be constructed of wood, plywood, or steel.
- All forms shall be set true to line, plumb, and properly braced so as to maintain the desired position and shape during and after pouring concrete. Forms shall be sufficiently tight to prevent leakage.
- All joints between sheets shall be backed up to assure that both sheets are in the same plane. Edges of abutting sheets shall be straight and true and shall be forced tightly together to minimize fins. Quality of form contact surfaces shall be subject to Owner's Representative's approval.
- Form ties shall be designed for the specific wall thickness required, and after

removal of the external portion, no metal shall remain closer than one inch (1") from the surface. Ties to be left in place shall be equipped with washers or other approved devices to prevent seepage of moisture along the tie. The removable portion shall be oil or grease coated.

- Immediately following the removal of forms, the projecting ties shall be removed and all holes filled with grout flush with the wall. Care shall be taken to use the same brand of cement and same mix proportions used in the wall to prevent color differences.
- Forms for walls and columns shall be provided with removable cleanout panels, to allow removal of chips and debris. All plywood forms must be new when first used on this job, but may be reused if kept in good condition. All forms shall be swept or flushed clean of shavings, debris, and other loose material. Loose earth and rock shall be scraped from footing trenches before pouring concrete.
- Provide 3/4" chamfer strips, unless noted otherwise on the drawings, at all exposed corners of columns, beams and walls where later finish is not to be applied.
- All forms and shores for floor and roof slabs and beams shall be "crowned" or "cambered" 1/4" for each 12 feet of span to eliminate dead load deflection. All forms shall be oiled with a non-staining mineral form oil before placing reinforcing.
- Build into forms all hangers, anchors, bolts, inserts, sleeves, etc., required to be set as part of this work, place and secure in exact position.

3.3.3 Form removal shall be as follows:

3.3.3.1 It shall be the Contractor's responsibility to determine the time at which forms may be removed without endangering the structure, subject to the following limitations, unless documentation is provided to modify these requirements:

Footing forms - 24 hours minimum; continue curing as specified.

Wall forms - 2 days minimum for ten (10) feet high. Add one (1) day for each additional five (5) feet of height; continue curing as specified.

Superstructure slabs, beams and columns shall not be stripped until the concrete attains at least 75% of its design strength as proven by test cylinders, and until a minimum of 14 days has elapsed.

Reshoring - immediately after stripping, fully reshore all slabs which are to be used to support shores for upper slabs. All forms for upper floor pours must be supported by shoring to at least two levels of full strength concrete.

3.4 JOINTS FOR CONCRETE:

3.4.1 Joints for concrete shall include all expansion joints, construction joints and contraction joints.

3.4.2 All joints shall be constructed at locations shown on the drawings, or as directed by the

Owner's Representative. Additional joints may be constructed by the Contractor subject to the approval of the Owner's Representative.

3.4.3 Expansion Joints:

3.4.3.1 Expansion joints shall be constructed where shown and as directed. Reinforcement, corner protection angles or other fixed items embedded or bonded into concrete shall not be run continuously through expansion joints. Reinforcement shall be discontinued 2 inches from the joint face. A slightly rounded edging shall be provided to finish neatly all edges around expansion joints.

3.4.3.2 Preformed expansion joint filler material, sealant and waterstops, where shown on the drawings, shall be as specified in Paragraph 2.1.

3.4.4 Construction Joints:

3.4.4.1 The location of construction joints shall be chosen by the Contractor and shall be subject to the Owner's Representative's approval except where specifically located on the Plans.

3.4.4.2 Horizontal construction joints in walls will not be permitted, except with the approval of the Owner's Representative. In order to minimize shrinkage, long continuous walls shall not be poured at one time. No more than 50 feet in horizontal direction shall be poured without a construction joint, unless prior approval is obtained from the Owner's Representative.

3.4.4.3 Reinforcing shall be discontinuous through a construction joint, unless otherwise noted on drawings. As shown or specified on the drawings, additional No. 3 reinforcing bars spaced at 12-inches on center shall be placed horizontally in each construction joint at the center of the section. These bars shall be 4-feet long and shall extend 2-feet on each side of the joint. Reinforcement projecting through joint shall be kept clean.

3.4.4.4 As indicated on the drawings, all construction joints shall be provided with a keyway and a PVC waterstop as specified in Paragraph 2.1. The joint surface of the concrete previously placed shall be cleaned of all foreign matter and laitance by means of sandblasting with steam and sharp sand, or by other approved methods, until coarse aggregate is exposed. The concrete surface shall be saturated for a period of 6 hours and excess water then removed.

3.4.4.5 The new concrete shall be preceded by about 1/2-inch of soft mortar of the same proportions as that in the concrete. When accessible, this shall be scrubbed into the surface of the joint with wire brooms. When waterproofing is required, the entire joint shall be parged with a grout of approved
mixture as recommended by the manufacturer of the waterproofing admixture, or one composed of one part integral waterproofing, three parts water and sufficient Portland Cement to form a thick, creamy mixture. This grout shall be fresh when followed by the new concrete. In column forms and deep narrow forms, the concrete placement shall be started with an oversanded mix with 5/8-inch maximum aggregate, and extra sack of cement per cubic yard, and a 5-inch slump.

This mix shall be placed maximum 2 inches deep on the construction joint. A mortar layer shall not be used.

3.4.4.6 As indicated on drawings, a metal keyed floor slab joint may be used in lieu of above method.

3.4.5 Contraction (Control) Joints:

3.4.5.1 Contraction joints shall be located as shown on the drawings or as directed. Reinforcement through the joint shall be continuous as shown on the drawings and/or as directed by the Owner's Representative.

3.4.5.2 Sawcut contraction joints (Type "A") shall be made by cutting the concrete surface and filling with the sealant material as specified under paragraph 2.1. Cutting shall be done after the surface is firm enough not to be damaged by the cutting blade. Time of cutting shall be approved by the Owner's Representative.

3.4.5.3 Formed contraction joints (Type "B") shall be made by tooling with a 1/4-inch radius edging tool and filled with the sealant material as specified under paragraph 2.1.

3.4.5.4 Premolded Contraction Joints (Type ■C•) shall be "Kold-Seal Zipper Strip" by Vinylex or "Zip Cap Control Joint" by Greenstreak Products, or equal.

3.4.5.5 As indicated on drawings, a metal keyed floor slab joint may be used in lieu of above method.

3.5 INSERTS AND SLEEVES:

3.5.1 The Contractor shall cooperate with all other Contractors in permitting the placing of all necessary sleeves, conduit, or inserts for hangers for their trades. The Contractor shall notify the trades of all pours in ample time for the responsible Contractor to place all embedded items, sleeves, slots, holes or chases.

3.5.2 Accurately set all slots, chases, anchor bolts, opening, etc. All inserts for hanging mechanical equipment shall be provided and set by the Contractor for the trade involved. All sleeves for piping passing through floors and walls shall be provided by the Contractor for the trade involved and set by the General Contractor.

3.5.3 All conduit which must be placed in concrete slabs shall be installed after, and above the bottom reinforcing, but before, and under the top reinforcing. Where conduit cross-overs are necessary, they shall be located so that reinforcing is not displaced from its specified position.

3.5.4 All anchor bolts for the structural steel shall be carefully set as shown on the fabricator's approved anchor bolt plan.

3.5.5 If, in the judgement of the Owner's Representative, embedded items are located or grouped in a manner that will weaken the structure, the Contractor shall take the necessary corrective steps.

3.5.6 All inserts and sleeves where the outside diameter is greater than the spacing between the reinforcing steel, the reinforcing bars shall be warped around such inserts and sleeves. Unless shown otherwise on the drawings, provide, as a minimum, two #4 diagonal bars per face at 90 degrees to each other all around the inserts and sleeves.

3.5.7 Where openings are left in new concrete or are made in existing concrete for the insertion of wall castings, pipes or other fixtures, the space around these fixtures shall be made watertight by completely filling with a non-shrinking concrete containing an admixture of "SikaSet-C", "Anti-Hydro" Concrete Waterproofing Agent, or equal.

3.6 CONVEYING AND PLACING CONCRETE:

3.6.1 The placing or depositing of all concrete shall be done in accordance with ACI 304, and as modified herein.

3.6.2 Preparation Prior to Placing Concrete:

a. Prepare previously placed concrete surfaces by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
b. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
c. Before placing concrete, all debris, water, snow and ice shall be removed from places to be occupied by concrete. Wood forms shall be wetted except in freezing weather or oiled, and the reinforcement cleaned of ice or other coatings.

3.6.3 Conveying, transporting, and placing shall be done as rapidly as practicable and without segregation, loss of ingredients, and without unnecessary rehandling. The tempering of concrete will not be permitted.

3.6.4 Concrete shall be deposited as nearly as practical to its final position to avoid segregation due to rehandling or flowing. The concreting shall be carried on at such a rate that the concrete is at all times plastic and workable and flows readily into the spaces between the reinforcing bars. No concrete that has partially hardened or been contaminated by foreign material shall be deposited on the work, nor shall retempered concrete be used. Once the concreting is started, it shall be carried on as a continuous operation until the placing of the panel or section is completed. All concrete shall be compacted by suitable means during the placing operation, and thoroughly worked around reinforcement and embedded fixtures and into corners of the forms. Tremies shall be used for deep forms, and concrete shall not be dropped more than 6'-0".

3.06.5 Vibrating:

3.6.5.1 During and immediately after depositing, all concrete shall be thoroughly compacted

by vibrating the concrete internally with mechanical vibrating equipment. Care must be taken not to over-vibrate the concrete. Maintain spare vibrator(s) at the site for use in the event of breakdowns.

3.6.5.2 Spade and work the coarse aggregate away from forms, and work concrete around reinforcement to avoid air pockets, voids, and honeycombed sections. Hand spading slabs will be required in addition to mechanical vibration.

3.6.6 During concreting, check shoring frequently with level. Strengthen or adjust shoring as required. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.

3.6.7 Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.

3.6.8 Screed all work to level surfaces at the proper elevations. Rake surfaces to provide bond for floor finishes where specified.

3.6.9 No concrete shall be deposited under water without written permission of the Owner's Representative and then only in accordance with his directions. Proper tremie equipment and techniques must be used, should the need arise.

3.6.10 The Contractor shall have available at all times sufficient approved materials such that, when started, concrete shall be continuous operation until placement of panel or section is complete. Should placing of concrete be suspended or unavoidably interrupted once a pour has been started, provide bulkheads and keyways at formed surface at which to stop pour.

3.6.11 All laitance shall be removed from previous pours before additional concrete is placed.

3.6.12 Place concrete continuously between predetermined expansion, control and construction joints.

3.7 PROTECTION AND CURING:

3.7.1 All concrete shall be protected against injury by sun, rain, freezing, mechanical damage, or premature drying. All concrete shall be maintained above 50°F in a moist or wet condition for at least the first 7 days after placement.

3.7.2 On vertical surfaces keep forms on, or cover with burlap blankets, kept wet. When forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safety.

3.7.2.1 For the preservation of moisture, apply one of the following procedures to concrete not in contact with forms, immediately after completion of placement and finishing:

a. continuous sprinkling
b. application of absorptive mats or fabric kept continuously wet
c. application of waterproof sheet materials as specified in Part 2, herein
d. application of the curing agent specified in Part 2, herein

3.7.3 On horizontal surfaces and floors to receive later finishes, cover with wet burlap, wet sand, or curing paper and keep saturated. Cement finish floors shall be covered with protective covering material with lapped and sealed edges after the concrete has set sufficiently to carry worker's weight. Covering shall remain in place until floor is cleaned. Weight covering with planks as required to hold it in place.

3.7.4 Cold weather protection shall conform to A.C.I. 306R, except as modified herein.

3.7.4.1 Prior to pouring, it shall be the Contractor's responsibility to keep the forms free from snow, ice, mud or debris at all times, by means of covers, enclosures, live steam or heating below the forms, as necessary. Use of torches, open flames, salts, straw, hay or chemical is prohibited.

3.7.4.2 When air temperature is 40°F, or less, use only heated concrete, delivered to the forms at temperatures between 65°F and 85°F. All portions of freshly poured concrete shall be continually maintained at a temperature of not less than 50°F for seven days. Specified temperature shall be maintained by heated enclosures, insulating blankets, insulated forms, or whatever approved methods are required to attain the specified result.

3.7.4.3 Concrete shall not be poured on frozen soil. After pouring, protect against freezing and heaving of subgrade. Any frozen concrete will be rejected and removed at the Contractor's expense. Accelerating admixtures shall not be accepted in lieu of winter protection.

3.7.5 Hot weather protection shall conform to ACI 305R, except as modified herein.

3.7.5.1 During warm dry weather special care and precautions should be taken to prevent premature setting which may cause shrinkage and surface checking. No concrete shall be placed at temperatures above 90°F without approval of the Owner’s Representative.

3.7.6 No water (except curing spray) shall be allowed to come in contact with the concrete or masonry surface for a minimum of 24 hours. Should the rising water place a stress on the concrete, proper bracing shall be provided. Loading shall not occur without prior approval by the Owner’s Representative, and proper safety precautions shall be the responsibility of the Contractor.

3.7.7 Curing compound may be used as specified in Paragraph 2.1 provided discoloration does not occur and application is in accordance with manufacturer's direction and is compatible with concrete finish.

3.8 FOOTINGS AND MATS:

3.8.1 Hand trim excavation to required levels.

3.8.2 Where shown on the drawings provide concrete mud mat to the thickness indicated.

3.8.3 Support reinforcing on bricks or precast blocks, or where mud mat is used, on chairs or bolsters, 3" clear of soil.

3.8.4 Columns and wall dowels shall be positioned, supported and tied in place before concrete is poured. Footing bottoms shall be inspected and approved by the Owner's Representative before placing mud mat or footings.

3.9 SUPPORTED SLABS ON FORMS:

3.9.1 Forms shall be built to required dimensions and camber as specified above. Reinforcing shall be located as shown on approved placing plans. Support bars at specified heights with bolsters, chairs, etc., so that reinforcing will not be moved from the specified position during placing of concrete.

3.9.2 Refer to paragraph 3.5 for installation of conduits.

3.10 SLABS ON GROUND:

3.10.1 Subgrade and base to be prepared as specified in Contract Documents.

3.10.2 Form depressed ribs under partitions as required by sloping gravel, or provide permanent side forms to retain gravel.

3.10.3 Trench subgrade for electric conduit as detailed on Plans. All reinforcing shall be above electric conduit.

3.10.4 Place slabs of thickness shown on Plans, vibrate, screed, float level, and finish as specified below.

3.11 CONCRETE FINISHES - FORMED SURFACES:

3.11.1 After the forms are removed, all concrete surfaces shall be inspected, and any poor joints, voids, stone pockets or other defective areas noted by the Owner's Representative shall be repaired immediately at the Contractor's expense by cutting away the unsound area to a minimum depth
of 1 inch, and refilling with mortar mixed using the same brand of cement as the original pour. Edges of the patch shall be square with the face, with feather-edging prohibited. Obtain approval of corrective action prior to repair.

3.11.2 Care shall be taken to saturate the patched area and holes shall be filled in 1/2-inch

layers with a delay for an initial set to take place before the succeeding layer is applied. If, in the opinion of the Owner's Representative, improper consolidation is too extensive, or if the structure appears weakened by the voids, complete removal of the concrete in question may be required. Patches shall be kept moist for a minimum of three days.

3.11.3 Rubbed finishes shall be as follows:

a. Type A: Surfaces shall be rubbed until all marks are obliterated and a uniformly smooth finish is obtained.

b. Type B: Surfaces shall be rubbed until they are uniformly smooth, but the complete obliteration of all marks is not required.

c. Type C: All fins, burrs and projections shall be removed, any honey-comb or tie-holes shall be filled and patched.

3.11.4 The type of finish to be used shall be as scheduled or as noted on the Plans. Where the type of finish is not shown or scheduled, exposed faces shall be given a Type B finish and unexposed faces shall be given Type C finish.

3.11.5 Rubbing shall begin as soon as practicable after removal of forms and shall be expedited to completion as rapidly as practicable.

3.11.6 Surfaces shall be rubbed with carborundum and water until all fins, bubbles, hollows and other defects are removed. Grout or mortar shall not be used in the rubbing process, and plastering of surfaces will not be permitted. Power tools shall be used for rubbing with hand work limited to inaccessible corners or very small areas.

3.12 FLOOR AND SLAB FINISHING:

3.12.1 Finished floors and slabs shall be level to within 1/8" of finish floor elevation in ten feet. If this variation occurs, it must not be abrupt, but must taper so that the 1/8" variation takes place in not under 4 feet. Areas with drains shall have the surfaces sloped uniformly and true to the effect that no surface ponding occurs. If required by the Owner's Representative, replace, grind or furnish underlayment to correct the variation, at the Contractor's expense. All floors and slabs shall be cured and protected as specified.

3.12.2 Trowelled Finish: Provide a floated finish, followed by a power troweling and then a hand troweling thoroughly consolidating the surface. Provide a finished surface essentially free from trowel marks and uniform in texture and appearance.

3.12.2.1 Where exposed concrete finish is specified, provide a steel trowelled finish.

3.12.2.2 Under quarry tile and ceramic tile screed to accurate lines and levels as required to receive these materials. Floors receiving tile are to be steel trowelled finished and are indicated on the Plans.

3.12.3 Float Finish: A float finish shall be applied to all exterior concrete and those areas not

intended for occupancy, such as culvert inverts, bottoms of manholes and catch basins, pads, etc.

3.12.4 Broom Finish: Provide a floated finish. While the surface is still plastic, provide a textured finish by drawing a fiber bustle broom uniformly over the surface in one direction only. Provide "medium" texturing unless noted otherwise on the Contract Drawings. Sidewalks, walkways, or exterior ramps shall be given a broom finish, perpendicular to traffic, sufficient to leave marks without appreciable disturbance of the surface.

3.12.5 Dusting with dry cement or cement sand mixtures, to hasten drying, is prohibited. Dry time shall be controlled by controlling the water content and slump of the concrete when placed.

3.13 BONDING:

3.13.1 For the bonding of new and old concrete, such provisions shall be made by means of steps, dovetails, bonding agents as specified in Paragraph 2.1, or other devices as shown, or directed.

3.13.2 When placing of concrete is suspended or unavoidably interrupted, all necessary grooves for bonding future work shall be made before the concrete has attained its initial set. When the work is resumed, concrete previously placed shall be roughened, cleaned of all foreign material and laitance by means of sandblasting with steam and sharp sand or other approved methods, until coarse aggregate is exposed, and thoroughly wetted and slushed with mortar containing the same proportion of cement and fine aggregate as used in the concrete to be placed. Follow manufacturer's preparation recommendations when using a bonding agent.

3.14 MISCELLANEOUS CONCRETE WORK:

3.14.1 Pour all sump pits, canopies, copings and provide all other miscellaneous concrete and cement work shown on the drawings. All such concrete shall be reinforced as shown. Provide all cement filled stair treads as detailed. Place bottoms and walls of pits and trenches monolithically or provide waterstops and keys.

3.14.2 Concrete Walks: Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet, unless otherwise indicated. Cut contraction joints 3/4-inch deep with a jointing tool after the surface has been finished. Provide 1/2-inch thick transverse expansion joints at changes in direction, where sidewalk abuts curb, steps, rigid pavement, or other similar structures. Provide a transverse slope of 1/4-inch per foot, and limit variation in cross section to 1/4-inch in 5 feet unless otherwise indicated.

3.14.3 Curbs and Gutters: Provide contraction joints spaced every 10 feet maximum, unless otherwise indicated. Cut contraction joints 3/4-inch deep with a jointing tool after the surface has been finished. Provide expansion joints 1/2-inch thick and spaced every 100 feet maximum, unless otherwise indicated. Provide a broom finish.

3.14.4 Equipment Bases: Unless otherwise shown, all equipment shall be erected on bases of Class "B" concrete. Thickness shall be as noted on the Plans, but at no time shall it measure less than 1 inch.

3.14.5 Concrete Stairs, Steps and Platforms: Stairs, steps and platforms shall be formed to required profiles shown on the Plans. Place reinforcing as required. Finish of stairs and steps shall be monolithic. Where shown on Plans, provide for nosings. Exterior stairs, steps and platforms shall have a non-slip finish. Before final troweling, embed abrasive grits, as specified in Paragraph 2.1, in the surface.

3.15 CEMENTITIOUS COATING:

3.15.1 Cementitious Coating shall be applied to all exposed exterior and interior Cast-In-Place Concrete surfaces except concrete floors and walking surfaces in accordance with the schedule shown on the Plans, or otherwise directed.

3.15.2 The surfaces to be coated shall be clean, free of all laitance, dirt, grease, curing compound, form treatments, efflorescence, paint and other foreign matter. All formed tie-rod holes and honeycombed areas shall be patched flush with the surrounding area using mortar as recommended by cementitious coating manufacturer.

3.15.3 All areas scheduled to be coated will receive two coats of cementitious coating as specified in Paragraph 2.1, applied at a minimum rate of 2 pounds per square yard per coat. The first coat shall be allowed to set before the second coat is applied. Sufficient materials shall be applied to fully seal all pores and voids. All coatings shall be done strictly in accordance with the manufacturer's recommendations.

++END OF SECTION++

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SECTION 03 3053
SITE MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes material and performance requirements for miscellaneous cast-in-place concrete for structural concrete, fill concrete, and grout for:
   1. Minor structures.
   2. Concrete pipe supports.
   3. Concrete thrust blocks.
   4. Grout for structural steel, equipment bases, and incidental Work.
   5. Fill concrete and benches within civil structures.

B. Concrete for paving, curbs, gutters, and sidewalks is specified elsewhere.

C. Related Work specified elsewhere:
   1. Section 32 1313, Concrete Paving.

1.2 REFERENCE STANDARDS

A. The following is a list of standards that may be referenced in this Section:
   1. ASTM International (ASTM):
      a. A184, Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
      b. A185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
      c. A497, Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
      d. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
      e. A706, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      f. A767, Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
      g. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
      h. A884, Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
      i. A934, Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
      j. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.

k. C33, Standard Specification for Concrete Aggregates.
l. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
m. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
n. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
o. C94, Standard Specification for Ready-Mixed Concrete.
p. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
q. C150, Standard Specification for Portland Cement.
r. C172, Standard Practice for Sampling Freshly Mixed Concrete.
s. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
t. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
u. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
v. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
w. C494, Standard Specification for Chemical Admixtures for Concrete.
x. C595, Standard Specification for Blended Hydraulic Cements.
y. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
z. C803, Test Method for Penetration Resistance of Hardened Concrete.
aa. C805, Test Method for Rebound Number of Hardened Concrete.
bb. C979, Standard Specification for Pigments for Integrally Colored Concrete.
cc. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
dd. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
ee. C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
ff. C1116, Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
gg. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
hh. C1330, Specification for Cylindrical Seal Backing for Use with Cold Liquid Applied Sealants.

ii. C1371, Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
jj. C1549, Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
kk. D920, Standard Specification for Elastomeric Joint Sealants.
ll. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
mm. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
nn. D1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
oo. D2628, Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete.
pp. D2828, Specification for Non-Bituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavement, Sawable Type.
qq. D3406, Specification for Joint Sealant, Hot-Applied, Elastomeric, Jet Fuel Resistant Type for Portland Cement Concrete Pavements.
rr. D3569, Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.
ss. D3581, Specification for Joint Sealant, Hot-Applied, Jet-Fuel-Resistant-Type, for Portland Cement and Tar-Concrete Pavements.
tt. D5249, Specification for Backer Material for Use With Cold- and Hot- Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.
uu. D5893, Specification for Cold-Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
vv. D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
ww. E329, Specification for Agencies Engaged in Testing and Inspection of Materials Used in Construction.

2. American Concrete Institute (ACI):
   a. 301, Specifications for Structural Concrete.
   b. 305R, Hot Weather Concreting.
   c. 306R, Cold Weather Concreting.
   d. 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete.

e. 308, Standard Practice for Curing Concrete.
f. 318/318R, Building Code Requirements for Structural Concrete and Commentary.
g. 325.9R, Guide for Construction of Concrete Pavements and Concrete Bases.

3. American Welding Society (AWS):

1.3 SUBMITTALS

A. Action submittals:
1. Submit batch plant's certified test results of the following:
a. Cement, mill test reports.
b. Aggregates, sieve analyses.
2. Product data and samples:
a. Submit manufacturer's information for material specified in Part 2 of this Section that will be incorporated into this project.
3. Mix design: Concrete mix design and compressive strength results of field trial batches for each class of concrete incorporated into the work.

B. Informational submittals:

C. Samples:
1. Submit a 6-inch sample of approved pre-molded joint filler for Engineer's and Resident Project Representative's reference.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. All packaged materials shall be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.

C. Remove damaged materials from the site immediately.

D. Store all packaged materials off the ground and protect from rain, freezing and excessive heat until ready for use. Comply with manufacturer's recommendations for storage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland cement: Comply with ASTM C150 Type I.

B. Fine aggregates:

1. Comply with ASTM C33.
2. Shall be clean, sharp, natural sand, free from loam, clay, organic impurities or frozen materials and shall conform to ASTM C33 in all respects.
3. Organic impurities shall not exceed limits specified in ASTM C40.

C. Coarse aggregate:
1. Comply with ASTM C33 and NYSDOT Material Designation 703-02.
2. Coarse aggregate shall consist of strong, clean, crushed limestone or crushed gravel, free from deleterious material.
3. Coarse aggregate shall meet the physical requirements designation 703-0201 and 703-0202, respectively.

D. Water used in mixing concrete shall be clean and free from all acid, alkali or organic matter and shall be obtained from a potable water supply unless specifically permitted otherwise by the Engineer.

E. Ready-mix concrete shall comply with ASTM Specification C94, this Specification, and used subject to the Engineer's approval.

F. Admixtures:
1. Air entraining agent:
   a. Daravair 1000 or Darex AEA, as manufactured by W.R. Grace Co.
   b. MasterAir, by BASF Master Builders.
   c. Or approved equal.
2. Water reducing agent:
   a. Plastiment, by Sika Corporation.
   b. Pozzolith, by BASF Master Builders.
   c. WRDA, by W.R. Grace.
3. High-range water reducers or superplasticizers:
   a. Sikament-FF, by Sika
   b. Daracem-100 or WRDA-19, by W.R. Grace.
   c. Or approved equal.

G. Bonding Agent:
1. Two-component, 100% solids, moisture-tolerant, structural epoxy adhesive.
2. Conform to ASTM C881, Types I, II, and V, Grade-2, Class C and AASHTO M235.
3. Product:
   a. Sikadur 32 Hi-Mod, by Sika Corporation.
   b. Or approved equal.

H. Forms and accessories:
1. Forms shall be wood, metal, or other approved materials as follows:

a. Plywood shall be commercial standard Douglas Fir, moisture resistant, concrete form plywood, at least 5-ply 5/8" thick.
b. Metal forms shall be as approved, and must produce surfaces equal to those specified for wood forms.

2. Form oil:
   a. Concrete form release compound shall be composed of an organic chemical that reacts with the alkali content of concrete to form a release film, along with providing an inert barrier to provide double separation.
   b. Form release compound shall be VOC-compliant, non-staining mineral oil, such as Duogard, by W.R. Meadows, or equal.
3. Form ties:
   a. Ties shall be adjustable length and free of devices that will leave hole or depression larger than 7/8" diameter.
   b. When forms are removed no metal shall be left within 1" of finished surface.

I. Pre-molded joint filler:
1. Expansion joint filler composed of granulated cork particles, resin-bonded into board form, compressed and dehydrated under heat and pressure, that will expand up to 140% of the original thickness after installation due to the re-absorption of moisture.
2. Joint filler shall conform to the following standards and have the following requirements:
   a. ASTM D1752, Type III.
   b. AASHTO M 213, Type II.
   c. ASTM D 545:
      1) Density Minimum: 16.0 lb/cu. ft.
      2) Load to Compress to 50% original thickness: 50 to 1500 psi.
      3) Recovery: 90%, minimum.
3. Thickness: 1/2-inch.
4. Manufacturer: Self-Expanding Cork Expansion Joint Filler, by W.R. Meadows.

J. Joint Sealant:
1. Single-component, elastomeric polyurethane sealant, gray in exposed locations.
2. Physical properties, cured:
   a. Tensile properties, per ASTM D412 at 21 days:
      1) Tensile Stress: 175 psi, minimum.
      2) Elongation at Break: 550%.
      3) Modulus of Elasticity:

a) 25%: 170 psi.
b) 50%: 130 psi.
c) 100%: 90 psi.

b. Shore A Hardness, per ASTM D2240 at 21 days: 45, +/-5.
c. Tear Strength, per ASTM D624 at 21 days: 55 lb./in.
d. Adhesion in Peel, per ASTM C794.
1) Concrete: 20-lb. min.: 0% adhesion loss.
2) Aluminum: 20-lb. min.: 0% adhesion loss.
3) Glass: 20-lb. min.: 0% adhesion loss.

3. Service Range: -40 degrees F to 170 degrees F.
4. The sealant shall conform to Federal Specification TT-S-00230C, Type II, Class A.
5. The sealant shall conform to ASTM C920, Type S, Grade NS, Class 35.
6. The sealant shall comply with NSF Standard 61 for use in contact with potable water.
7. The sealant shall be non-staining.
8. VOC content: 8 g/L.
9. Products:
a. MasterSeal NP1, by BASF MasterBuilders.
b. Sikaflex 1A, by Sika Corporation.
c. Or approved equal.

K. Grout:
1. Non-metallic, non-shrink cementitious grout for structural applications.
2. Products:
a. Masterflow 100, by Master Builders / BASF.
b. Sika Grout 212, by Sika Corporation.
c. Or approved equal.

L. Liquid Hardener:
1. Lapidolith, by Conren.
2. EmeryTop 400, by Laticrete International, Inc.
3. Or approved equal.

M. Curing compound:
1. Acrylic-based:
a. Kure-N-Seal, by Sonneborn.
b. CS-309, by W.R. Meadows.
2. Water-based:
a. VOCOMP-20, by W.R. Meadows.

2.2 MIX DESIGN

A. The various classes of concrete shall be designated as follows:

MAXIMUM PERMISSIBLE WATER-CEMENT RATIOS FOR CONCRETE (WHEN STRENGTH DATA FROM TRIAL BATCHES OR FIELD EXPERIENCE ARE NOT AVAILABLE)

CLASS	MIN. 28-DAY COMPRESSIVE STRENGTH IN PSI*	NON-AIR-ENTRAINED CONCRETE		AIR-ENTRAINED CONCRETE	
		ABSOLUTE RATIO BY WEIGHT	US GAL. PER 94-LB. BAG OF CEMENT	ABSOLUTE RATIO BY WEIGHT	US GAL. PER 94-LB. BAG OF CEMENT
A	5,000	**	**	**	**
B	4,000	0.44	5.0	0.35	4.0
C	3,000	0.58	6.6	0.46	5.2
D	2,500	0.67	7.6	0.54	6.1
E	2,000	0.71	8.0	-	-

*28-day strength. With most materials, water/cement ratios shown will provide average strengths greater than indicated in Section 5.4 of ACI 318R as being required.

*For strength above 4,500 psi (non-air-entrained concrete) and 4,000 psi (air-entrained concrete) proportions shall be established by methods of Sections 5.3 or 5.4 of ACI 318R.

B. Unless otherwise specified, all concrete shall be Class B, non-air-entrained except exposed concrete which shall be air-entrained. When foundation walls or grade beams are exposed to weather above grade, the entire wall shall be considered exposed concrete.

C. Maximum aggregate size:

1. 1-1/2": general work.
2. 3/4": Sections less than 12 inches thick, heavy reinforcing; slabs.
3. 3/8": floor toppings.

D. Maximum slump:
1. Reinforced concrete: 4 inches.
2. Reinforced concrete, walls less than 12 inches thick: 5 inches.
3. Columns: 5 inches.
4. Non-reinforced concrete: 3 inches.

E. Air Content:
1. The entrained air shall be controlled between 4% and 6%.
2. For mixes containing coarse aggregate 3/4-inch or smaller and for exposed concrete subject to frost and salt action, increase air entrainment to 5% to 7%.

PART 3 EXECUTION

3.1 BATCHING AND MIXING

A. The Contractor shall have available at all times sufficient approved materials such that, when once started, concreting shall be a continuous operation until the placing of the panel or section is completed. The top surface shall be generally level. When construction joints become necessary, they shall be made as hereinafter specified.

B. All concrete shall be mixed not less than 60 revolutions in the drum of a modern power mixer, at the rated speed of rotation. Mix not less than an additional 30 revolutions after the addition of any further water to the mix.

C. Transit-mixed concrete shall be transported to the job site unmixed and only after arrival at the job site shall mixing begin. All concrete shall be unloaded from the mixer within 45 minutes after completion of mixing. All concrete still remaining in the truck shall be rejected.

D. The total time interval from the time the cement makes contact with the aggregate to the complete unloading from the mixer shall not exceed 90 minutes, unless such time is extended by the Engineer. The time may be reduced in hot weather or under unusual conditions, if unsatisfactory results are obtained.

3.2 FORMWORK

A. The Contractor shall design and construct suitable and adequate formwork in conformance with ACI 347R.

B. All shoring shall be properly braced to safely withstand all vertical, moving and lateral forces during the construction period.

C. Set forms true to line and grade and make mortar-tight.

D. Chamfer above grade exposed joints, edges, and external corners of concrete 3/4-inch, unless otherwise indicated.

E. Before concrete placement, coat the contact surfaces of forms with a non-staining form coating compound.

F. Do not use mineral oil on formed surfaces to be painted. Prevent concrete damage during form removal.

G. Concrete for footings may be placed in excavations without forms upon inspection and approval by the Engineer.

H. Excavation width shall be a minimum of 4 inches greater than finished dimensions indicated.

I. It shall be the Contractor's responsibility to determine the time at which forms may be removed without endangering the structure, subject to the following limitations, unless documentation is provided to modify these requirements:
   1. Footing forms: 24 hours minimum; continue curing as specified.
   2. Wall forms: 2 days minimum for ten (10) feet high. Add one (1) day for each additional five (5) feet of height; continue curing as specified.

3.3 JOINTS FOR CONCRETE:

A. Expansion joints:
   1. Expansion joints shall be constructed where shown and as directed.
   2. Reinforcement, corner protection angles or other fixed items embedded or bonded into concrete shall not be run continuously through expansion joints.
   3. Reinforcement shall be discontinued 2 inches from the joint face.
   4. Tool joint edges to provide a rounded finish at all expansion joints.
   5. Install preformed expansion joint filler material and sealant, where shown on the drawings.

B. Construction joints:
   1. The location of construction joints shall be chosen by the Contractor and shall be subject to the Engineer's approval except where specifically located on the Plans.
   2. Horizontal construction joints in walls will not be permitted.
   3. Reinforcing shall be discontinuous through a construction joint, unless otherwise noted on drawings.

4. As shown or specified on the drawings, additional No. 3 reinforcing bars spaced at 12 inches on center shall be placed horizontally in each construction joint at the center of the section.
5. These bars shall be 4 feet long and shall extend 2 feet on each side of the joint.
6. Reinforcement projecting through joint shall be kept clean.
7. As indicated on the drawings, all construction joints shall be provided with a keyway.

C. Control joints:
1. Locate as shown on the drawings or as directed.
2. Reinforcement through the joint shall be continuous as shown on the drawings and/or as directed by the Engineer.
3. Type A control joint:
   a. Sawcut control joints shall be made by cutting the concrete surface and filling with the sealant material.
   b. Cutting shall be done after the surface is firm enough not to be damaged by the cutting blade.
   c. Time of cutting shall be approved by the Engineer.
4. Type B control joint: Tooled control joint shall be made by tooling with a 1/4-inch radius edging tool and filled with the sealant.
5. Type C control joint:
   a. Premolded control joints shall be Kold-Seal Zipper Strip, by Vinylex, Zip Cap Control Joint by Greenstreak Products, or approved equal.

3.4 INSERTS AND SLEEVES:

A. Coordinate with all other contractors in the placement of necessary sleeves, conduits, and inserts.

B. The General Contractor shall notify the trades of all pours in sufficient time for the responsible Contractor to place all embedded items, sleeves, slots, holes or chases.

C. Accurately set all slots, chases, anchor bolts, and openings.

D. All inserts for hanging mechanical equipment shall be provided and set by the Contractor for the trade involved.

E. All sleeves for piping passing through floors and walls shall be provided by the Contractor for the trade involved and set by the General Contractor.

F. All conduit which must be placed in concrete slabs shall be installed after, and above the bottom reinforcing, but before, and under the top reinforcing.

G. Where conduit cross-overs are necessary, they shall be located so that reinforcing is not displaced from its specified position.

H. If, in the judgement of the Engineer, embedded items are located or grouped in a manner that will weaken the structure, the Contractor shall take the necessary corrective steps.

I. All inserts and sleeves where the outside diameter is greater than the spacing between the reinforcing steel, the reinforcing bars shall be warped around such inserts and sleeves.

J. Unless shown otherwise on the drawings, provide, as a minimum, two #4 diagonal bars per face at 90 degrees to each other all around the inserts and sleeves.

K. Where openings are left in new concrete or are made in existing concrete for the insertion of wall castings, pipes or other fixtures, the space around these fixtures shall be made watertight by completely filling with a non-shrinking concrete containing an admixture of "SikaSet-C", "Anti-Hydro" Concrete Waterproofing Agent, or equal.

3.5 CONVEYING AND PLACING CONCRETE:

A. The placing or depositing of all concrete shall be done in accordance with ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete and as modified herein.

B. Before placing concrete, all debris, water, snow and ice shall be removed from places to be occupied by concrete.

C. Wood forms shall be wetted except in freezing weather or oiled, and the reinforcement cleaned of ice or other coatings.

D. Conveying, transporting, and placing shall be done as rapidly as practicable and without segregation, loss of ingredients, and without unnecessary rehandling.

E. Re-tempering concrete is not permitted.

F. Spade and work the coarse aggregate away from forms and work concrete around reinforcement to avoid air pockets, voids, and honeycombed sections.

G. The use of a mechanical vibrator is mandatory, but concrete must not be over-vibrated.

H. Hand spading will be required in addition to mechanical vibration.

I. Maintain spare vibrator(s) at site for use in case of breakdowns.

J. Screed all work to level surfaces at the proper elevations. Rake surfaces to provide bond for floor finishes where specified.

K. No concrete shall be deposited under water without written permission of the Engineer and then only in accordance with his directions.

L. Proper tremie equipment and techniques must be used, should the need arise.

3.6 FIELD QUALITY CONTROL

A. The Contractor shall employ an approved commercial testing laboratory at his own expense to provide field sampling, testing and inspection of all concrete.

B. Continuous inspection by the approved testing laboratory shall be provided during all concrete pours.

C. The Contractor shall maintain a record set of plans at the site showing date and amount of each pour, test results and temperature.

D. If any portion of the work shows low test results, the Engineer may require additional testing, load tests, cored samples, and/or replacement of the faulty work, etc., at the Contractor's expense.

E. Field concrete inspection: The Contractor, thru its approved testing laboratory, shall provide a competent field concrete inspector whose minimum duties shall be as follows:
   1. Collect and verify with each batch of concrete, before unloading at the site, a delivery ticket on which is printed, stamped, or written, information concerning said concrete. Have available for Engineer to review if requested.
   2. Check each truck on arrival to make sure that the concrete is not retempered.
   3. Make necessary slump tests for uniformity control.
   4. Make air tests and yield tests as required.
   5. Make any and all test cylinders as may be required in the Specifications.
   6. Transport cylinders from the site to the laboratory.
   7. Notify the Engineers and/or his representative if any test results vary from the specified limits.

F. Tests:
   1. Concrete shall be tested by an approved testing laboratory as follows:

a. Standard 6" x 12" compression cylinders shall be in compliance with ASTM C39 in sets of four and shall be moist cured.
b. Break two cylinders at 7 days, and two cylinders at 28 days.
c. One set shall be made for approval of each mix design, one set for first pour of 50 cubic yards or less, and one set for each additional pour of 50 cubic yards.
d. If less than 50 cubic yards are placed in one day, one set shall be made for each day's pour.
e. All test cylinders shall be cast, moist cured and broken under laboratory conditions in accordance with the ASTM C31 and ASTM C39.
f. All four cylinders of a test shall be taken from the middle third of a single load.
g. Each cylinder shall be properly labeled with an identifying mark, the mix proportions, air content, amount of water, slump, and the location in the structure where the concrete was placed.
h. Test reports shall include all this information.
i. Distribute copies of reports as requested by the Engineer.
j. Should any results be questionable, the Engineer shall be notified immediately so that corrective measures can be taken.
k. Test cylinders that fails to meet requirements shall be preserved for inspection by the Engineer.

3.7 INSPECTION

A. Before each pour, forms and reinforcing shall be inspected and approved by the Engineer.

B. The Contractor shall give at least 24 hours' notice before such an inspection is required. No pour shall be started until the Engineer has given approval.

C. No concreting may be done in the absence of the Engineer without written permission of the Engineer.

3.8 PROTECTION AND CURING

A. All concrete shall be protected against injury by sun, rain, freezing, mechanical damage, or premature drying.

B. All concrete shall be maintained above 50 degrees F in a moist or wet condition for at least the first 7 days after placement.

C. On vertical surfaces keep forms on, or cover with burlap blankets, kept wet.

D. On horizontal surfaces and floors to receive later finishes, cover with wet burlap, wet sand, or curing paper and keep saturated.

E. Cement finish floors shall be covered with protective covering material with lapped and sealed edges after the concrete has set sufficiently to carry worker's weight.

F. Covering shall remain in place until floor is cleaned. Weight covering with planks as required to hold it in place.

G. Cold weather concreting:
1. Cold weather protection shall conform to A.C.I. 306R, Cold Weather Concreting except as herein modified.
2. Keep the forms free from snow, ice, mud, and other deleterious materials prior to placing concrete.
3. Use of torches, open flames, salts, straw, hay or chemical is prohibited.
4. When air temperature is 40 degrees F, or less, use only heated concrete, delivered to the forms at temperatures between 65 degrees F and 85 degrees F.
5. All portions of freshly poured concrete shall be continually maintained at a temperature of not less than 50 degrees F for seven days.
6. Specified temperature shall be maintained by heated enclosures, insulating blankets, insulated forms, or whatever approved methods are required to attain the specified result.
7. Concrete shall not be placed on frozen soil
8. After placement, protect against freezing and heaving of subgrade.
9. Frozen concrete will be rejected and removed at the Contractor’s expense.
10. Accelerating admixtures shall not be accepted in lieu of winter protection.

H. Hot weather concreting:
1. Hot weather concreting shall conform to ACI 305R, Hot Weather Concreting except as modified herein.
2. During warm dry weather special care and precautions should be taken to prevent premature setting which may cause shrinkage and surface checking.
3. No concrete shall be placed at temperatures above 90 degrees F without approval of the Engineer.
4. No water (except curing spray) shall be allowed to come in contact with the concrete or masonry surface for a minimum of 24 hours.
5. Should the rising water place a stress on the concrete, proper bracing shall be provided.
6. Loading shall not occur without prior approval by the Engineer, and proper safety precautions shall be the responsibility of the Contractor.

7. Curing compound may be used as specified herein, provided discoloration does not occur and application is in accordance with manufacturer's direction and is compatible with concrete finish.

3.9 SLABS ON GRADE

A. Prepare subgrade and base as specified herein Contract Documents.

B. Form depressed ribs under partitions as required by sloping gravel, or provide permanent side forms to retain gravel.

C. Trench subgrade for electric conduit as detailed on Plans.

D. Place all reinforcing above electrical conduit.

E. Place slabs of thickness shown on Plans, vibrate, screed, float level, and finish as specified herein.

3.10 FINISHING, FORMED SURFACES FINISHES

A. After the forms are removed, all concrete surfaces shall be inspected, and any poor joints, voids, stone pockets or other defective areas noted by the Engineer shall be repaired immediately at the Contractor’s expense by cutting away the unsound area to a minimum depth of 1 inch, and refilling with mortar mixed using the same brand of cement as the original batch.

B. Edges of the patch shall be square with the face, with feather-edging prohibited. Obtain approval of corrective action prior to repair.

C. Care shall be taken to saturate the patched area and holes shall be filled in 1/2-inch layers with a delay for an initial set to take place before the succeeding layer is applied.

D. If, in the opinion of the Engineer, improper consolidation is too extensive, or if the structure appears weakened by the voids, complete removal of the concrete in question may be required.

E. Patches shall be kept moist for a minimum of three days.

3.11 FLOOR AND SLAB FINISHING:

A. Finished floors and slabs shall be level to within 1/8” of finish floor elevation in ten feet.

B. If this variation occurs, it must not be abrupt, but must taper so that the 1/8” variation takes place in not under 4 feet.

C. Areas with drains shall have the surfaces sloped uniformly and true to the effect that no surface ponding occurs.

D. If required by the Engineer, replace, grind or furnish underlayment to correct the variation, at the Contractor's expense.

E. All floors and slabs shall be cured and protected as specified.

F. Under quarry tile and ceramic tile screed and float top surface of slab, after concrete has been compacted, to accurate lines and levels as required to receive these materials.

G. Floors receiving a tile finish are indicated on the Plans.

H. Where exposed concrete finish is specified, provide a steel trowelled finish.

I. After concrete has set sufficiently to carry the weight of the workman, float with motor-driven rubber disc machine to thoroughly compact and close any surface voids.

J. Dusting with dry cement or cement sand mixtures, to hasten drying, is prohibited.

K. Dry time shall be controlled by controlling the water content and slump of the concrete when placed.

L. Liquid hardener, as specified herein, shall be applied to exposed concrete finish floors where shown on the Contract Drawings.

M. Cure floors thoroughly.

N. Hardener shall be applied in accordance with Manufacturer's directions in at least two coat application, allowing 24 hours between coats.

O. Coverage, for each coat, shall be one gallon per 100 square feet.

P. After final coat is complete and dry, remove surplus hardener by scrubbing and mopping with water.

Q. A float finish shall be applied to all exterior concrete and those areas not intended for occupancy, such as culvert inverts, bottoms of manholes and catch basins, pads, etc.

3.12 MISCELLANEOUS CONCRETE WORK

A. General:

1. Pour all sump pits, canopies, copings and provide all other miscellaneous concrete and cement work shown on the drawings.
2. All such concrete shall be reinforced as shown. Provide all cement filled stair treads as detailed.
3. Place bottoms and walls of pits and trenches monolithically.

B. Concrete walks, curbs and gutters: Comply with Section 32 1313, Concrete Paving.

C. Equipment Bases:
1. Unless otherwise shown, all equipment shall be erected on bases of Class B concrete.
2. Thickness shall be as noted on the Plans, but at no time shall it measure less than 1 inch.

++END OF SECTION++

SECTION 03 5400
CAST UNDERLAYMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.

1. Use cementitious type at all locations.

1.3 RELATED REQUIREMENTS

A. Section 01 7000 - Execution:

B. Section 09 6500 - Resilient Flooring for flashing patching.

C. Section 09 3000 - Tiling.

1.4 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.

B. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2018.

C. ASTM F-2170 Relative Humidity in Concrete.

D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Manufacturer's Instructions.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of underlayments for compliance with requirements indicated.

E. Minutes of preinstallation conference.

F. Submit certification, in writing by the finish floor manufacturer that the Cast Underlayment is compatible and acceptable for their product,

1.6 QUALITY ASSURANCE

A. Manufacturer: Provide underlayment manufactured by a firm with a minimum of ten (10) years experience with types equivalent to those specified.

1. Manufacturer capable of providing technical training and field service representation.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years of experience who has completed work similar in material, design, and extent to that indicated for this Project and approved by the manufacturer.

C. Testing Agency Qualifications: An independent testing agency, acceptable to Owner's Representative and Architect, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 01 3000 - Administrative Requirements.

E. Product must have a hydraulic cement-based inorganic binder content as the primary binder which includes portland cement per ASTM C150: Standard Specification for Portland Cement and other specialty hydraulic cements. Gypsum-based products are not acceptable.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products in a dry area with temperature maintained between 50° and 85°F (10° and 29°C) and protect from direct sunlight

C. Handle products in accordance with manufacturer's printed recommendations

1.8 REGULATORY REQUIREMENTS

A. Conform to New York State Building Codes and all other applicable codes for combustibility or flame spread requirements.

1.9 MOCK-UP

A. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Prepare mock-up in location designated by Owner's Representative.

2. Area: 6 ft by 6 ft.

3. Do not proceed with underlayment work until workmanship of mock-up has been approved by Construction Manager

4. If Construction Manager determines that mockups do not meet requirements, demolish and remove them from the site and cast others until mockups are approved.

5. Mock-up may remain as part of the Work.

1.10 FIELD CONDITIONS

A. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting underlayments performance.

B. During the curing process, ventilate spaces to remove excess moisture.

C. Close areas to traffic during underlayments application and, after application, for time period recommended in writing by manufacturer

1.11 WARRANTY

A. Provide manufacturer's comprehensive ten)10) year warranty.

1. Verify material is acceptable with adhesives use with finish floor systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cementitious Underlayment: Basis of Design:

1. ARDEX Engineered Cements; ARDEX K 15 with ARDEX P51 Primer: www.ardexamericas.com.

2. Substitutions: Section 01 2500 Substitution Procedures.

2.2 MATERIALS

A. Cast Underlayments, General:

1. Comply with applicable code for combustibility or flame spread requirements.

a. Refer to Section 01 4100 - Regulatory Requirements.

B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:

1. Compressive Strength: Minimum 5,5000 pounds per square inch after 28 days, tested per ASTM C109/C109M.

2. Flexural Strength: Minimum 1200 psi after 28 days, tested per ASTM C348.

3. Shrinkage: 0.025 - 0.045% @ 28 days when tested in conformance with ASTM C 531 (modified).

4. Ideal Slump range 11.5” - 12.5” (2” diameter pipe, 4” high).

5. Bond Strength: 350-400 psi when tested in conformance with ASTM D 3931

6. “0” VOC content

7. Final Set Time: 2 to 3hours.

8. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.

9. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.

D. Reinforcement: Galvanized metal lath complying with recommendations of underlayment manufacturer for specific project circumstances.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

F. Primer: Ardex P 51

G. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix using a ½" (12 mm) heavy-duty drill (min. 650 rpm) with an mixing paddle. Do not over water. When mixing sanded materials, follow manufacturer's recommendations, or use a standard "gutter hook" vacuum attachment in combination with a wet/dry (Shop-Vac® style) vacuum and HEPA dust extraction vacuum system. Additionally, each bag should be handled with care and emptied slowly to avoid creating a plume of dust. Contact the manufacturer's Technical Service Department for more details on products and air quality management.

C. Aggregate mix: For areas to be installed over 1 ½" (4 cm) thick, aggregate may be added to reduce ` material costs. Mix Underlayment with water first, then add 1 part aggregate by volume of washed, well-graded 1/8" to 3/8" (3 to 9.5 mm) pea gravel. The aggregate size must not exceed 1/3 the depth of the pour. Do not use sand. Note: The addition of aggregate will diminish the workability of the product and may make it necessary to install a finish coat to obtain a smooth surface. Allow the initial application to dry for 12 to 16 hours, and then prime this layer with primer mixed 1: 1 with water. Allow the primer to dry (min. 30 minutes, max. 24 hours) before installing the neat coat of underlayment

D. For pump installations, underlayment shall be mixed using the Automatic Mixing Pumps. recommended by the manufacturer Contact the manufacturer's Technical Service Department for complete pump operation instructions.

E. Mix to self-leveling consistency without over-watering and in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test moisture content of substrates:

1. Per ASTM F2170, do not install if relative humidity is > 95% (15 pounds per 1000 sq. ft. per 24 hours ASTM F1869) up to and including 98% Relative Humidity (20 pounds per 1000 sq. ft. per 24 hours ASTM F 1869) without first applying TEC® The LiquiDAM® moisture mitigation membrane.

a. Cost of mitigation testing shall be included in the Contractor's proposal.

2. For moisture sensitive floor finishes refer to the finish floor manufacturers specifications for moisture limitations. Remediation of excessive moisture conditions **must be done prior to** installation of Self Leveling Underlayment. To reduce moisture vapor emissions to an acceptable level, use material recommended by the manufacturer.

3. Refer to finish flooring systems for additional requirements.

B. Notify the Owner's Representative and Architect in writing of any unsatisfactory conditions.

C. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch

1. After profiling test substrate by place drop of water, or other means to insure all coatings, sealers etc have been removed. Repeat profiling if necessary.

2. Prepare and clean existing base slabs according to topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.

3. Mechanically remove contaminants from existing concrete that might impair bond of topping.

4. Saw cut existing contraction and construction joints to a depth of 1/2 inch and fill with epoxy joint filler.

B. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

C. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

D. Vacuum clean surfaces.

E. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

F. Close former roof and floor openings where items and equipment have been removed and as indicated.

G. Close floor openings.

3.3 APPLICATION OF PRIMER

A. Install products in accordance with manufacturer's instructions.

B. Prime standard subfloors with manufacturer's recommended solvent-free primer.

1. Mix Primer 1:1 with water and apply evenly with stiff bristled push broom.

2. Apply an even continuous coat.

3. Allow to dry to a clear film (typically 30 minutes; maximum 24 hours).

4. Do not apply underlayment until the primer is dry.

   a. To determine if the primer is dry after a minimum of 30 minutes (max. 24 hours), pour water onto the surface of the primer in several areas and rub it with your finger. If the water remains clear, the primer is dry. If the water turns cloudy or milky, additional drying time is needed.

5. Primer coverage is approximately 400 to 450 sq. ft. per gallon depending on surface texture.

6. Prime extremely absorbent subfloors twice.

3.4 APPLICATION OF UNDERLAYMENT

A. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch, without puddling. Place topping while adhesive is still tacky

B. Install underlayment in accordance with manufacturer's instructions.

C. Pump or pour material onto substrate. Do not retemper or add water.

1. Pump, move, and screed while the material is still highly flowable.

2. Be careful not to create cold joints.

3. Wear spiked shoes while working in the wet material to avoid leaving marks.

D. Place to required thickness, with top surface level to 1/16 inch in 10 ft.

E. For final thickness over 1-1/2 inches, place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.

F. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

G. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of topping, at locations indicated or as approved by Owner’s Representative.

1. Coat face of construction joint with epoxy adhesive at locations where topping is placed against hardened or partially hardened topping.

H. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before topping develops random contraction cracks.

1. Form joints in topping over contraction joints in base slabs, unless otherwise indicated.

2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.

3. Construct contraction joints for a depth equal to one-half of topping thickness, but not less than 1/2 inch deep

I. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.5 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

Underlayment can be walked on in 2-3 hours. Moisture-insensitive tiles such as ceramic, quarry and porcelain can be installed after 6 hours. All other finish floor coverings can be installed after 16 hours at 70°F (21°C). For resinous systems such as epoxy and polyurethane floors please contact the manufacturer's Technical Services Department.

3.6 JOINT FILLING

A. Prepare and clean contraction joints and install epoxy joint filler, according to manufacturer's written instructions, once topping has fully cured.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install epoxy joint filler full depth of contraction joints. Overfill joint and trim joint filler flush with top of joint after hardening

3.7 FIELD QUALITY CONTROL

A. An independent testing agency will perform field inspection and testing, as specified in Section 01 4000 - Quality Requirements.

3.8 REPAIRS

A. Defective Topping: Repair and patch defective topping areas, including areas that have not bonded to concrete substrate

3.9 PROTECTION

A. Do not permit traffic over unprotected floor underlayment surfaces.

SECTION 04 0100
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Dust control.

B. Removal and rebuilding of masonry units where indicated on drawings.

C. Salvaging and re-using existing brick units.

D. Mortar.

E. Cavity-wall insulation

F. Protection of roof surfaces.

1.3 RELATED REQUIREMENTS

A. Section 01 1000 - Summary of Contracts for Sequence of Work

B. Section 01 2000 - Price and Payment Procedures

C. Section 01 5000 - Temporary Facilities and Controls.

D. Section 04 2000 - Unit Masonry: Brick masonry units.

E. Section 05 5000 - Metal Fabrications.

F. Section 06 1000 - Rough Carpentry.

G. Section 06 1010 - Roof Related Rough Carpentry.

H. Section 07 5010 - Modifications to Existing Roofing.

I. Section 07 6200 - Sheet Metal Flashing and Trim

J. Section 07 9200 - Joint Sealants.

K. Section 09 9113 - Exterior Painting.

L. Section 09 9123 - Interior Painting.

1.4 Reference Standards

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2008.

C. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

D. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

E. New York State Parks, Recreation & Historic Preservation Brief #2 Guidelines.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene two weeks prior to commencing work of this section.

1. Require attendance of parties directly affecting work of this section.

1.6 SUBMITTALS

A. See Section f01 3000 - Administrative Requirementsor submittal procedures.

B. Product Data: Provide data on all material, including recommended installation procedures.

C. Samples: Submit four samples of face brick units to illustrate matching color, texture and extremes of color range.

1. For each type of mortar provide 6 inch long by 1/2 inch wide sample strips set in metal or plastic channels.

2. Each type of anchor

D. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

E. Test reports and certifications substantiating compliance with specification requirements.

F. Material Safety Data Sheets.

1.7 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Qualification: The sub-contractor with a minimum of five years experience, experienced masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

1. The Installer shall directly employ the personnel performing the work of this section

2. The Installer shall have a full time supervisor/foreman on the roof when roofing work is in progress. The Supervisor shall have a minimum of 5 years experience in roofing work similar in nature and scope to this project, and speak fluent English

3. Submit a reference list which shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.

C. The Installer shall provide a reference list of at least three (3) projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:

1. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner’s name - contact person - phone number and address and the Architect’s name - contact person and phone number.

2. The Installer shall provide the reference list prior to contract award if requested.

D. Source Limitations: Obtain each type of material for masonry restoration (face brick, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.

E. Pre-Work Conference: Attend the pre-roofing meeting and discuss the following:

1. How masonry work will be performed and coordinated with other work.

2. How the building will be kept watertight as masonry work progresses.

3. The construction schedule, forecast weather, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.

4. A schedule for Manufacturer and Architect inspections.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Carefully pack, handle, and ship masonry units and accessories strapped together in suitable packs or pallets or in heavy cartons.

B. Deliver material to the site in the Manufacturer's original and unopened containers and packaging, bearing labels which identify the type and names of the products and Manufacturers. Unload and handle to prevent chipping and breakage.

C. Protect masonry materials and aggregates during storage and construction from excess wetting by rain, snow or ground water, and from staining or inter mixture with earth or other types of materials.

D. Protect grout, mortar and cement products from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Protect liquid components from freezing.

E. Do not overload the structure when storing materials on he roof.

1.9 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

C. Repoint mortar joints and repair masonry only when air temperature is between and 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of work.

D. Erect temporary covers over pedestrian walkways and at building entrances and exits which will remain active as the work progresses.

E. Prevent mortar from staining the face of surrounding masonry and other building surfaces, immediately remove any which falls or spills. Protect sills, ledges and projections from mortar droppings.

F. Coordinate masonry removal and restoration with the installation of new metal and membrane flashings

1.10 GUARANTEE

A. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a two year period beginning upon Final Completion:

1. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, and undue expansion.

2. The Contractor's Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense:

3. The Guarantee shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to affect guaranteed repairs.

B. The Contractor's Guarantee shall be issued no more than 30 days before the satisfactory completion of punch list work.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

A. Cleaning Agent:ProSoCo; Sure Klean Light-Duty Restoration Cleaner Cathedral Stone.Syra G. by Cathedral Stone® Products, Inc

1. Application: General Cleaning of existing masonry units.

B. Cleaning Agent:ProSoCo; Sure Klean 600 Detergent

1. Application: General Cleaning of new masonry units.

C. Masonry Sealer: ProSoCo Sure Klean Weather Seal Siloxane PD.

1. Application: Sealer for brick masonry.

a. Use for all masonry wall surfaces except where graffiti protection is indicate.

2.2 MASONRY MATERIALS

A. Brick shall be clay or shale, ASTM C216, Type FBS , solid. Brick shall be tested for efflorescence in accordance with ASTM Test Methods C67 and the rating shall be ”Not Effloresce”.

1. Use 100% solid brick over exterior relieving angles/lintels or other brick projections on exterior face of building. (Use of solid brick with cores is acceptable if cores are filled solid with mortar and the cores are not visible to view.

B. Include special bricks for corners, and other special shapes, to match the color, surface texture, shape and size of existing adjacent brick.

C. Face Brick and Accessories: Provide face brick and accessories, including specially molded, ground, cut, or sawed shapes where required to complete masonry restoration work.

D. Provide units with colors, surface texture, and physical properties to match existing units in size and shape.

1. For sample that exhibits a range of colors, provide brick that matches that range rather than brick that matches an individual color within that range.

2. Provide special shapes as indicated and required to match existing.

2.3 MASONRY ANCHORS

A. All reinforcement and anchors located in exterior walls shall be stainless steel.

B. Anchors: Type and size indicated, or if not indicated, to match existing in size and type. Fabricate anchors and dowels from Type 302 or Type 304 stainless steel.

C. Strap Anchors: Bent steel shapes configured as required for specific situations, 1/-1/2 in width, 0.105 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, stainless steel.

1. Length: Verify in field.

2. Hohmann & Barnard weld on ties #345.

D. Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties or tabs spaced at 16 in on center and fabricated with moisture drip; stainless steel wire conforming to ASTM A 580/A 580M Type 304; 0.1875 inch side rods with 0.1875 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face. Flush weld all keys. Provide stainless steel for exterior walls.

1. Seismic Feature: Provide lip, hook, or clip on extended leg of wall ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.

2. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

a. Truss #170 with DW-10 Seismiclip Hohmann & Barnard.

2.4 ACCESSORIES

A. Sealant Refer to Section 09 9113 - Exterior Painting.

B. Weeps: Cellular, honeycomb design, polypropylene weep vents for embedding in masonry wall mortar joints;

1. Material: High density polyethylene and impervious to water and resistant to UV degradation.

2. Hohmann & Barnard, Inc. #QV - Quadro-Vent.

C. Paint: Refer to Section09 9113 - Exterior Painting.

1. Refer to Finish schedule.

D. Joint Filler: Closed cell neoprene; 3/8" inch wide x 3" wide x by maximum lengths available. Provide tear strip to permit sealant joint.

1. Manufacturers:

a. Hohmann & Barnard, Inc; Product MS: www.h-b.com.

2.5 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashings and Trim - Refer to Section 07 6200 - Sheet Metal Flashing and Trim.

2.6 CAVITY WALL INSULATION

A. Extruded-Polystyrene Board Insulation: Rigid, cellular, polystyrene thermal insulation with closed cells and integral high-density skin; formed by the expansion of polystyrene base resin with a carbon-black filler in an extrusion process to comply with the following characteristics:

1. Aged thermal resistance (R-value) for 1-inch thickness of 5.0, deg F x h x sq. ft./Btu at 75 deg F at 5 years.

B. Products: Owens Corning “High Performance Foamular 250” 2”x 16”x 96” R-10 for masonry backup application.

C. Cavity Insulation Joint Sealing Tape: Rubber asphalt membrane. 40 mil thick, consisting of 36 mil self adhering rubberized asphalt membrane laminated to a 4 mil high density polyethylene film and removable release sheet.

1. Minimum width: 4”.

a. Primer: As recommended by the manufacturer for application over extruded polystyrene insulation

2.7 MORTAR MIXES

A. Comply with ASTM C 270, Proportion Specification

1. Setting mortar, use Type N.

2. Brick Replacement Mortar: Type S .

3. Pointing mortar Type N.

a. Verify strength of existing mortar. New mortar shall not exceed strength of existing mortar.

B. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match existing.

C. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material

D. Do not use admixtures of any kind in mortar, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this section.

3.2 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Separate areas to be protected from restoration areas using means adequate to prevent damage.

C. Cover existing landscaping with tarpaulins or similar covers.

D. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures, including:

1. Windows.

2. Soft joints and sealants.

3. Door frames.

4. Vents, louvers and grills

E. Close off adjacent occupied areas with dust proof partitions.

F. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

G. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.3 BRICK REMOVAL AND REPLACEMENT

A. Carefully remove bricks on a piece by piece basis. Cut out full units from joint to joint and to permit replacement with full size units. Clean the edges of remaining bricks, to remove all mortar, dust, and loose debris in preparation for rebuilding

B. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

C. Simultaneously remove limited sections of existing masonry; support and protect masonry remaining next to and above the removal areas

D. Support structure as necessary in advance of cutting out units.

E. The Contractor is responsible for performing Work in a safe manner. Provide temporary shoring or other supports as required to prevent displacement of existing masonry that is to remain. Perform the removal Work with such care as may be required to prevent failure of the masonry or damage to adjoining masonry that is to remain

F. Cut away loose or unsound adjoining masonry and mortar as directed. Do not use impact type tools, use only rotary type grinders.

G. Use power tools only after test cuts determine no damage to masonry units will result. Provide vacuum attachment for all grinding/cutting equipment for dust control purposes.

H. Do not damage masonry units.

I. Build in new units following procedures for new work:

1. Mortar Mix: Colored and proportioned to match existing work.

2. Ensure that anchors, ties, reinforcing, and flashings are correctly located and built in.

3. Install new cap flashings, and wall flashing extensions, properly connected to the existing wall flashings, as indicated on the drawings and specified elsewhere before installing new bricks

4. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings. Use a motor driven diamond blade saw to cut bricks with clean, sharp, unchipped edges.

5. Install through wall flashings properly connected to the existing wall as indicated. before installing the new bricks

6. Toothe in new brick with existing brick at all locations.

7. Wet brick which have initial rates of absorption (suction) of more than 30 grams per 30 square inches per minute, (in accordance with ASTM C 67), to ensure the bricks are nearly saturated with water, but surface dry when laid

8. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min.. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid. Maintain joint width for replacement units to match existing joints.

9. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area

10. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brick work

3.4 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place continuous joint reinforcement in first and second joint below top of walls.

C. Lap joint reinforcement ends minimum 6 inches.

3.5 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

A. Place continuous joint reinforcement in first and second joint below top of walls.

3.6 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Install flashing entire face of the exterior face of the interior CMU unit.

2. Extend flashings full width at such interruptions and at least 4 inches into adjacent masonry or turn up at least 8 inches to form watertight pan at non-masonry construction.

3. Remove or cover protrusions or sharp edges that could puncture flashings.

4. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend rubber flashings down and under masonry to within 1/4 inch of exterior face of masonry.

C. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

3.7 GENERAL CLEANING AND PROTECTION PROCEDURES

A. Protect persons and surrounding surfaces of building being restored from harm resulting from masonry restoration work.

1. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.

2. Comply with cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

3. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written

instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

4. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures, including:

   a. Windows.

   b. Soft joints and sealants.

   c. Door frames.

   d. Vents, louvers and grills

5. Keep wall wet below area being cleaned to prevent streaking from runoff.

6. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.

7. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.

8. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

B. Prevent mortar from staining face of surrounding masonry and other surfaces.

1. Cover sills, ledges, and projections to protect from mortar droppings.

2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.

3. Immediately remove mortar in contact with exposed masonry and other surfaces.

4. Clean mortar splatters from scaffolding at end of each day

C. Apply all material in strict accordance with the manufacturer's instructions.

D. Protect people, vehicles, property, plants, non masonry surfaces from product splash, residue, wind drift and fumes.

E. Do not apply when surface and air temperature falls below 50 degrees.

3.8 CLEANING NEW BRICK MASONRY

A. Test surface for cleaning effectiveness.

B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

C. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

D. Before solution dries, rinse and remove acid solution and dissolved mortar, using clean, pressurized water.

1. Apply 400-1000 psi pressure, water flow rate of 6-8 gallons per minute, to masonry surfaces , maintaining uniform depth and surface texture throughout. Use 15-45 degree fan spray. If required heat water to 150-180 degree.

2. Let dwell 3 to 5 minutes. Do not let let cleaner dry on the surface. Fresh water rinse the surfaces below areas being cleaned to prevent streaking.

3. Repeat steps as required

3.9 FIELD QUALITY CONTROL

A. Inspectors: Owner may engage qualified inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

B. Notify Owner's Representative, Architect, and Construction Manager in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until inspectors have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

3.10 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Concrete Masonry Units (CMU).

B. Clay facing brick.

C. Common brick.

D. Reinforcement and anchorage.

E. Flashings.

F. Accessories.

1.3 RELATED REQUIREMENTS

A. Section 04 0100 - Maintenance of Masonry.

B. Section 05 5000 - Metal Fabrications: Loose steel lintels.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

D. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

E. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.4 MATERIAL EVALUATION/QUALITY ASSURANCE

A. Preconstruction Testing: Contractor shall employ and pay qualified independent Testing Agency to perform preconstruction testing indicated and other inspecting and testing services required for source and field quality control.

1. Clay Unit Masonry Tests: For each different clay masonry unit indicated, test units in accordance with ASTM C 67.

2. Concrete Masonry Unit Tests: For each different concrete masonry unit indicated, test units for strength, absorption, and moisture content in accordance with ASTM C 140.

3. Prism Tests: For each type of wall construction indicated, test masonry prisms in accordance with ASTM C 1314.

a. Contractor shall fabricate prisms under supervision and direction of Testing Agency Representative.

4. Test mortar composition and properties in accordance with ASTM C 270 if Property Specification is used.

5. Evaluate mortar proportions in accordance with ASTM C 270 if Proportion Specification is used.

6. Test mortar properties for approved mix in accordance with ASTM C780 (Compressive Strength Method) to determine a base line for field mortar tests.

7. Test grout compressive strength in accordance with ASTM C 1019 to demonstrate compliance with ASTM C476, Property Specification.

a. Contractor shall deliver to Testing Agency accepted CMU for fabrication of test samples.

B. Testing Agency Qualifications: Independent Testing Agency shall demonstrate to Owner's representative 's satisfaction that it has experience and capability to satisfactorily perform testing indicated without delaying progress of work.

C. Contractor shall employ and pay a licensed Land Surveyor to survey foundations for compliance with dimensional tolerances specified in referenced unit masonry standard.

D. Preinstallation Conference: Perform conference at project site to comply with requirements of Division 1 section "Project Meetings.".

E. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture will visit construction site at appropriate intervals to determine if work is in general conformance with Contract Documents and specifications. Notify RDPs 48 hours before anticipated time of completion for given section of work so they may determine if site observations are required. If site observations are required, do not place grout or continue construction of masonry until RDPs have had opportunity to make observations.

1.5 SPECIAL INSPECTIONS

A. Refer to Specification Section 014533 and Schedule of Special Inspections

1.6 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2018

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2018.

D. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2016.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018, with Editorial Revision (2018).

F. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.

H. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.

I. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2017.

J. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2018.

K. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.

L. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.

M. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2017a.

N. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

O. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.

P. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

Q. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

R. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

S. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2016.

T. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting two (2) weeks before starting work of this section; require attendance by all relevant installers and Construction Manager.

1.8 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, all masonry accessories, and anchors.

1. Material Data: Submit to Architect and Construction Manager certificates for the following signed by manufacturer and Contractor certifying each material complies with requirements.

a. Masonry Units.

b. Each different cement product required for mortar and grout, including name of manufacturer, brand, and type.

c. Each material and grade indicated for reinforcing bars.

d. Each type and size of joint reinforcement.

e. Each type and size of anchors, ties, and metal accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.

D. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

F. Test Reports: Concrete masonry manufacturer's test reports for: units with integral water repellent admixture.

1. Mortar: Property (Proportion) requirements of ASTM C 270.

2. Grout complying with ASTM C 476. Include description of type and proportions of grout ingredients.

3. Masonry units: ASTM C67 and ASTM C140.

4. Field Mortar Base Line Compressive Test: ASTM C780.

5. Efflorescence tests for Brick: ASTM C67.

6. Durability tests for surface-coated brick: ASTM C67.

G. Designer's Qualification Statement.

H. Material Data: Submit to Special Inspector and Architect/Engineer certificates for the following signed by manufacturer and Contractor certifying each material complies with requirements.

1. Masonry Units.

2. Each different cement product required for mortar and grout, including name of manufacturer, brand, and type.

3. Integral Water Repellant used in CMU.

4. Each material and grade indicated for reinforcing bars.

5. Each type and size of joint reinforcement.

6. Each type and size of anchors, ties, and metal accessories.

I. Material Test Reports: Submit to Special Inspector and Architect/Engineer reports from qualified independent Testing Agency employed and paid by Contractor indicating and interpreting test results relative to compliance for the following proposed masonry materials with requirements indicated:

1. Mortar: Property (Proportion) requirements of ASTM C 270.

2. Grout complying with ASTM C 476. Include description of type and proportions of grout ingredients.

3. Masonry units: ASTM C67 and ASTM C140.

4. Field Mortar Base Line Compressive Test: ASTM C780.

5. Efflorescence tests for Brick: ASTM C67.

6. Durability tests for surface-coated brick: ASTM C67.

J. Construction Procedures: Submit cold-weather construction and hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard

K. Grouting Program: Submit proposed grouting program for grouting CMU walls. Grouting shall be in accordance with recommendations of NCMA-TEK 3-2A

1.9 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1. Submit data for firms and persons specified to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Architects and Owners, and other information specified.

D. Grouting and Reinforcing: All masonry and grouting and reinforcing work shall be performed by masonry craft-workers who have successfully completed the International Masonry Institute (1-800-IMI-0988) training course for Grouting and Reinforced Masonry Construction, or equal.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1. Provide manufacturer's certification for fire ratings.

2. Equivalent thickness as determined by ASTM C 140.

a. Aggregate: Limestone.

a) One hour rated:

(a) 6” CMU: 55% solid.

(b) 8” CMU: 53% solid.

(c) 10” CMU: 51.7 solid.

b) Two hour rated:

(a) 6” CMU: 75% solid.

(b) 8” CMU: 53% solid.

(c) 10” CMU: 51.7% solid

c) Three hour rated:

(a) 8” CMU: 75% solid

F. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required

1.10 MOCK-UPs

A. Locate where directed.

B. Mock-up may not remain as part of work.

C. Build mockup of typical wall area as directed by Construction Manager.

D. Build mockups for the following types of masonry in sizes approximately 8 feet long by 6 feet high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches long in each mockup.

1. Each type of exposed unit masonry construction including pre-cast units.

2. Include mortar, accessories, structural backup, reinforcement, flashings (with lap joint, corner, and end dam), weather barrier, and wall insulation.

3. Typical exterior wall, including precast units.

4. Typical exterior wall with lower corner of window opening framed with stone trim at upper corner of mockup. Make opening approximately 36 inches wide by 36 inches high. Show jamb construction, special coursing and bands.

5. Typical exterior wall with through-wall flashing installed for a 24-inch length in corner of mockup approximately 16-inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

6. Typical steel stud framing or masonry backup.

7. Show sheathing, cavity insulation, joint reinforcing, drainage board, weather barrier, mortar net and weeps.

8. Typical interior unit masonry wall.

E. Clean exposed faces of mockups with masonry cleaner as indicated.

F. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.

G. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.

H. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

I. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

1. Approval of mockups is also for other material and construction qualities specifically approved by Architect and Construction Manager in writing.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect and Construction Manager in writing.

3. **No work shall commence until mock-up is completely approved.**

J. Demolish and remove mockups when directed Construction Manager.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store pre-faced concrete block units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

C. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

F. Deliver pre blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

G. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil

H. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

1.12 WORKMANSHIP

A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Construction Manager.

B. Remove work found to be defective. Replace with new acceptable work.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Materials General

1. Unit Masonry Standard: Comply with TMS 402/602/ACI 530.1/ASCE 6 “Specifications for Masonry Structures” except where exceeded by the requirements of the contract documents.

2. Fire Performance Characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined in accordance with ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means as acceptable to authorities having jurisdiction.

3. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color or uniform blend within ranges accepted for these characteristics from one manufacturer for each different product required for each continuous surface or visually related surfaces.

4. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

2.2 CONCRETE MASONRY UNITS

A. Concrete Masonry Units: Comply with referenced standards and as follows:

1. Lightweight block units shall not be used.

2. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.

    a. Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated in drawings. If not shown in drawings, use length to produce coursing with little or no cutting.

3. Special Shapes: Provide nonstandard blocks configured for corners, lintels, and control joint edges.

4. Load-Bearing Units: ASTM C90, normal weight.

    a. Hollow block, as indicated.

    b. Exposed Faces: Special color and texture where indicated.

    c. Strength: Minimum 2,000 psi @ 28 days.

5. Nonloadbearing Units: ASTM C129.

    a. Normal weight.

    b. Strength: Minimum 2,500 @ 28 days.

6. Pre-Faced Trim Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.

    a. Facing Components: Facing ingredients must be manufacturer's compound made with polymers, supplied by the manufacturer to approved manufacturer's authorized fabricators and other ingredients as required to meet or exceed manufacture's product standards including ASTM C 744.

    b. Exterior use, smooth, satin finish, conforming to the manufacturer's latest published standards and ASTM C 744, ASTM C 67, paragraph 8 (freeze-thaw) and Thermal Shock Test B 100JL, 2 4 P.

    c. Sizes: As indicated on drawings.

2.3 CLAY MASONRY UNITS

A. General: Comply with the following requirements applicable to each form of brick required:

1. Provide special molded shapes where indicated and as follows:

    a. For applications requiring brick of form, color, texture, and size on exposed surfaces that cannot be produced by sawing standard brick sizes.

    b. For applications where stretcher units cannot accommodate special conditions including those at corners, movement joints, bond beams, sashes, and lintels.

B. Provide units without frogs.

C. Provide units without cores where cores would be exposed to view

D. Face Brick: ASTM C216, Type FBS, Grade SW.

1. Color and texture to match match existing building and new units as selected by Architect..

2. Nominal size: match existing.

3. Compressive strength: 12,309 psi, average, measured in accordance with ASTM C67.

4. Initial Rate of Absorption: Less than 15.33% when tested per ASTM C 67.

5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresce."

6. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet

E. Building (Common) Brick: ASTM C62, Grade SW; solid units.

1. Nominal size: 3-5/8" x 2-1/4" x 7-5/8".

2. Compressive strength: 3,000 psi, measured in accordance with ASTM C67/C67M.

3. Application: Use where brick is indicated for concealed locations.

2.4 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 0511.

2.5 REINFORCEMENT AND ANCHORAGE

A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.

B. All reinforcement and anchors for masonry, located in exterior walls, shall be hot dipped galvanized steel.

C. All reinforcement and anchors located in interior walls shall be hot dipped galvanized steel.

D. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

E. Deformed Reinforcing Wire: ASTM A 496.

F. Plain-Welded Wire Fabric: ASTM A 185.

G. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

H. Single Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss.

2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to 16 CFR 1201 Class B.

3. Size: 0.1483 inch (9 ga.) side rods with 0.1483 inch (9 ga.) cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure. Flush weld all keys

4. Hohmann & Barnard - #120.

I. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss.

2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to 16 CFR 1201 Class B.

3. Size: 0.1483 inch (9 ga.) side rods with 0.1483 inch (9 ga.) cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure. Flush weld all keys.

4. Hohmann & Barnard - #130.

J. Masonry Veneer Anchors: 2-piece wall ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

1. Truss Wire Size: 0.1483 inch (9 ga.) side rods with 0.1483 inch (9 ga.) cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure. Flush weld all keys.

2. Eye Wire: 3/16" dia.

3. Leg Hook: 3/16" dia. wire.

K. Partition Anchors: Partition anchors to provide lateral shear at upper limit of masonry wall with neoprene pad and anchor.

1. Hohmann & Barnard PTA-420 Series

2.6 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashings and Trim - Refer to Section 07 6200 - Sheet Metal Flashing and Trim.

B. Combination Asphaltic Flashing Materials - Copper:

1. Copper/Asphalt Flashing: 3 oz/sq ft copper sheet bonded between 2 layers asphalt saturated glass fabric.

2. Width: 24".

3. Drip Plate: Stainless Steel. 3-1/2"Flat or Drip as shown on drawings.

4. Manufacturers:

a. Hohmann & Barnard, Inc; Copper Thru Wall Flashing C-Coat Flashing: www.h-b.com.

b. Substitutions: See Section 01 2500 - Substitution Procedures.

c. Hohmann & Barnard, Inc; Copper-Fabric NA: www.h-b.com/#sle.

C. Termination Bars: Stainless steel; compatible with membrane and adhesives.

1. Manufacturers:

a. Hohmann & Barnard, Inc; T2- FTS: www.h-b.com/#sle.

D. Drip Edge: Stainless steel; angled drip with hemmed edge and flat drip with hemmed edge as shown on drawings and compatible with membrane and adhesives.

E. Size: 3-1/2".

1. Manufacturers:

a. Hohmann & Barnard, Inc; FTSA Drip plate : www.h-b.com/#sle.

b. Substitutions: See Section 01 2500 - Substitution Procedures.

F. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.7 ACCESSORIES

A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

1. Manufacturers:

a. Hohmann & Barnard, Inc; -: www.h-b.com/sle.

b. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Cavity Mortar Control: Semi-rigid high density polyethylene panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

1. Size: 10" high x 4' x thickness as required.

2. Manufacturers:

a. Hohmann & Barnard, Inc; Mortar Trap.

C. Weeps:

1. Type: Polypropylene.

2. Size: 3/8" thick x 3" wide x 2 ½" tall.

3. Manufacturers:

a. Hohmann & Barnard, Inc; QV - Quadro-Vent: www.h-b.com/sle.

b. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.1483-inch steel wire, hot-dip galvanized after fabrication.

1. Provide units with either two loops or four loops as needed for number of bars indicated.

a. Hohmann & Barnard, Inc. #RB Rebar Positioner

2.8 MASONRY CLEANERS

A. Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Products: :

a. Cleaners for Red and light-colored Brick Not Subject to Metallic Staining with Mortar Not Subject to Bleaching:

a) ProSoCo, Inc.Sure Klean No. 600 Detergent

b. Substitutions: See Section 01 2500 - Substitution Procedures

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions with installer on-site for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry.

1. For record, prepare written report, endorsed by installer, listing conditions detrimental to performance of unit masonry.

2. Verify that foundations are within tolerances specified.

3. Verify that reinforcing dowels are properly placed.

4. Verify that substrates are free of substances that impair mortar bond.

5. Verify that field conditions are acceptable and are ready to receive masonry.

6. Verify that related items provided under other sections are properly sized and located.

7. Verify that built-in items are in proper location, and ready for roughing into masonry work.

B. Examine rough in and built in construction to verify actual locations of piping connections prior to installation.

C. Examine mechanical vibrators to be used for grout consolidation prior to grout delivery to verify vibrators are in proper working order.

D. Notify Construction Manager if construction is not acceptable.

E. Do not proceed with construction until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work or as required by TMS 402/602.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work or as required by TMS 402/602.

1. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 IMIAC and the following:

a. When the ambient temperature is within the limits indicated, use the following procedures:

a) 40 to 32 deg F (4 to 0 deg C): Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C).

b) 32 to 25 deg F (0 to -4 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry.

c) 25 to 20 deg F (-4 to -7 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C) if grouting. Use heat on both sides of walls under construction.

d) 20 deg F (-7 deg C) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C). Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F (0 deg C) within the enclosures.

e) Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:

(a) 40 to 25 deg F (4 to -4 deg C): Cover masonry with a weather-resistant membrane for 48 hours after construction.

(b) 25 to 20 deg F (-4 to -7 deg C): Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h (25 km/h).

(c) 20 deg F (-7 deg C) and Below: Provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after construction.

f) Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

2. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

a. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

b. Verify moister content in brick. If dry wet bricks prior to installation.

a) Comply with the requirements of IMIAC.

3.4 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Where one wythe of multi wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to un constructed wythe and hold cover in place.

3. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

4. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

a. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.

b. Protect sills, ledges, and projections from mortar droppings.

c. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

d. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

5. **Under no circumstances shall masonry installation cease or be delayed due to the weather conditions. Installation shall continue using procedures listed above.**

3.5 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets.

B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry as follows unless indicated otherwise in drawings:

1. Do not use units with less than nominal 4?inch horizontal face dimensions.

2. One-half running bond with vertical joint in each course centered on units in courses above and below.

3. Avoid use of less than half sized units at corners, jambs, and where possible at other locations.

4. Where indicated in drawings, match coursing, bonding, color, and texture of new masonry with existing masonry.

5. Toothe in new masonry to existing at all locations.

D. Lay concealed masonry with units in wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4?inch-horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back one-half unit length for one-half running bond or one-third unit length for one third running bond. Do not tooth. Clean exposed surfaces of set masonry. Wet clay masonry units lightly if required. Remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-In Work: As construction progresses, build-in items specified under this and other sections of specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow-metal frames and masonry solidly with mortar unless otherwise indicated.

a. At exterior frames, insert extruded polystyrene board insulation around perimeter of frame in thickness indicated but not less than 3/4 inch to act as thermal break between frame and masonry.

2. Where built-in items are to be embedded in cores of hollow masonry units, place layer of metal lath in joint below and rod mortar or grout into core.

3. Fill cores in hollow concrete masonry units with grout three courses (24 inches) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

G. Build chases and recesses as shown or required to accommodate items specified in this and other sections of specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

H. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to opening.

I. Nonbearing Interior Partitions: Build full height of story to underside of solid floor or roof structure above and as follows.

1. Install compressible filler in joint between top of partition and underside of structure above. Brace top of wall as shown in drawings.

J. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent mortar and grout leakage. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

3.6 INSTALLATION OF MASONRY UNITS

A. General: Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in project.

1. Masonry units shall be laid true, level, plumb and in uniform coursing in accordance with drawings. Corners and angles shall be square unless otherwise indicated in drawings.

2. Lay only dry concrete masonry units. Do not wet concrete masonry units unless approved.

3. Adjust masonry units into final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove mortar, clean joints and units, and relay units with fresh mortar.

4. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual thickness of masonry units using units of nominal thickness indicated.

5. Use full-sized units without cutting where possible. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction.

6. Use concrete brick as miscellaneous infill at pockets and elsewhere as needed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

C. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

D. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.7 MORTAR BEDDING AND JOINTING

A. Mortar joint at foundation shall not be less than ¼ inch or more than ¾ inch in thickness. Provide full mortar coverage for bed joint at foundation, except do not project mortar into cells to be grouted. Fill head and bed joints of hollow units with mortar for thickness of face shell. Solid units shall have full head and bed joints.

B. Set stone units in full bed of mortar with vertical joints slushed full. Fill dowel, anchor, and similar holes solid. Wet stone joint surface thoroughly before setting. For stone surfaces that are soiled, clean bedding and exposed surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

C. If it is necessary to remove a unit after it has been set in place, remove unit, clean, and set in fresh mortar.

D. Nominal mortar joint thickness shall be 3/8 + 1/8 inch for precision units and 1/2 + 1/8 inch for slumped units.

E. Mortar joints with wire reinforcement shall be at least twice the wire diameter of the wire.

F. Mortar joints shall be straight, clean, and uniform in thickness.

G. Unless otherwise specified or noted in drawings, tool mortar joints with a concave surface except for the following:

1. Walls to be plastered shall have flush cut or sacked mortar joints.

2. Walls to be concealed by other materials shall have flush cut joints.

3. For joints facing cavities/air spaces, strike joints flush. No voids allowed.

H. Perform tooling when mortar is partially set but still sufficiently plastic to bond. Tooling shall be performed with a tool that compacts mortar.

I. Place and construct control joints as shown in drawings. Keep joints clean from mortar drippings and other debris.

3.8 INSTALLATION OF REINFORCING STEEL

A. Place reinforcement as detailed in drawings. Secure against displacement prior to grouting. Horizontal bars may rest on cross web of hollow units.

B. Tolerances for placement of reinforcing steel in walls and flexural members shall be as follows:

1. Plus/minus 1/2 inch for d equal to 8 inches or less.

2. Plus/minus 1 inch for d equal to 24 inches or less but greater than 8 inches.

3. Plus/minus 1 ½ inches for d equal to 24 inches or less.

4. Plus/minus 2 inches for longitudinal location of reinforcement.

C. Clearance between reinforcing steel and surface of masonry shall not be less than ¼ inch for fine grout and ½ inch for coarse grout.

D. Lap reinforcing bars as shown in drawings.

E. Positioners: Provide positioners to maintain position of vertical reinforcing bars at each lap splice or at maximum spacing of 10 feet, whichever is less. Where these positioners are within ½ inch of surface of masonry, galvanize according to ASTM Standard A 153.

F. Provide continuous bond beams reinforced with two No. 5 bars at floors, roof, and tops of parapets unless otherwise noted. Provide corner bars same size as continuous reinforcing in wall corners and intersections, lapped 2 feet with continuous reinforcing.

G. Provide minimum vertical reinforcing of one No. 4 bar in window and door jambs, at ends of walls, corners, and each side of vertical control joints. Locate bar maximum 16 inches from end of CMU. If typical vertical wall reinforcing noted is larger than No. 4, use larger size.

3.9 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods fully embedded in mortar for their entire length with minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing minimum 8 inches.

1. Install single-wythe horizontal joint reinforcing in concrete masonry veneer at 16 inches on center vertically unless noted otherwise.

2. Provide additional joint reinforcement not more than 8 inches above and below wall openings and extending at least 12 inches beyond openings.

3. Cut or interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

4. Provide continuity at corners by use of prefabricated "L" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

B. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide continuity with:

1. Horizontal joint reinforcement using prefabricated "T" sections.

a. Rigid metal anchors at 48 inches on-center.

3.10 GROUTING

A. General

1. Use grout to fill masonry. Do not use mortar.

2. Reinforcement must be in place prior to grouting.

3. Install vertical grout dams at maximum horizontal spacing of 30 feet to control horizontal flow of grout. For walls partially grouted, use expanded metal lath mesh or other material that will not interfere with bond to restrict grout into only those cells that are to be grouted.

4. After mortar joints have set, remove protruding mortar fins that excessively constrict grout space.

5. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

6. Grout to 1½ inches below top of masonry units for each lift to form and interlock with subsequent masonry and grouting. Where bond beams occur, stop grout pour minimum 1½ inch below top of masonry. At top of masonry, fill grout space flush with tops of units and consolidate.

7. Solidly grout cells and spaces containing reinforcing steel for partially grouted walls. For solid grouted walls, grout all cells.

8. Consolidate grout using mechanical vibrator and reconsolidate using mechanical vibrator after excess water is absorbed into masonry units.

    a. Do not consolidate or reconsolidate self-consolidating grout.

B. Low Pour Grouting:

1. Construct masonry wall up to 5 feet 4 inches pour height (vertically) at a time. Minimum height of grout lift creating a cold joint shall equal splice length of reinforcing indicated in drawings.

2. Install vertical and horizontal reinforcing steel, anchors, and embedded items as masonry work progresses.

3. Grout walls in 5 foot 4 inch maximum lifts, consolidating and reconsolidating each lift. Stop grout 1½ inch below top of top course.

    a. Do not consolidate or reconsolidate self-consolidating grout.

C. High Pour Grouting

1. Construct masonry wall up to 24 feet maximum pour height without grouting.

2. Provide cleanout openings at base of wall:

    a. At vertical reinforcing bars.

    b. At spacing of no more than 32 inches on center for solid grouted walls.

    c. At spacing of no more than 48 inches on center for partially grouted walls.

3. Install horizontal reinforcing steel, anchors, and embedded items as masonry work progresses. Vertical reinforcing steel may be placed during or after wall is constructed but must be secured in place prior to grouting.

4. Provide positioners to secure vertical reinforcement in correct location.

5. Remove mortar droppings and other debris through cleanouts at base of wall. After cleanouts have been inspected, seal and brace cleanouts.

6. Grout walls in 5 foot 4 inch maximum lifts, consolidating and reconsolidating each lift.

   a. Do not consolidate or reconsolidate self-consolidating grout.

   b. Alternate Lift Height: Where the following conditions are met, maximum lift height may be increased to 12 foot 8 inches:

      a) Masonry wall must be cured for a minimum of 4 hours.

      b) No intermediate horizontal reinforcing steel (bond beam) is present.

7. If grouting is to be stopped for more than one hour during a pour, stop grout 1½ inch below top of uppermost grouted unit (top of pour). Where additional masonry is to be laid above a given pour, stop grout 1½ inch below top of top course.

3.11 BONDING CAVITY WALLS/MULTIWYTHE MASONRY

A. Bond wythes together using the following method:

1. Individual Two-Piece Wire Ties: Use continuous horizontal joint reinforcing with individual ties installed in horizontal joints spaced not to exceed 16 inches on-center horizontally and 16 inches on-center vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 8 inches on-center around perimeter of openings. Provide two-piece adjustable ties where wythes do not align.

3.12 ANCHORED MASONRY VENEER TO LIGHT-GAUGE BACKUP WALLS

A. Anchor single-wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing and insulation to metal studs as indicated.

2. Install Self-Sealing Tape behind anchor sections.

3. Embed tie section in masonry joints. Provide air space between back of masonry veneer wythe and face of sheathing or insulation as indicated on the drawings.

4. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.

5. Space anchors as indicated but not more than 16 inches on-center vertically and horizontally. Install additional anchors within 1 foot of openings and at intervals around perimeter not exceeding 8 inches.

B. If masonry veneer is concrete-masonry, provide single-wythe joint reinforcing at 16 inches vertically, staggered with ties.

3.13 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide open space not less than 1 inch wide between masonry and structural member unless otherwise indicated. Keep open space free of mortar or other rigid materials.

2. Anchor masonry to structural members with adjustable anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated but not more than 16 inches on center vertically and horizontally.

3.14 MOVEMENT (CONTROL AND EXPANSION) JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as masonry progresses. Do not form continuous span through movement joints unless provisions are made to prevent in-place restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control joint gaskets designed to fit standard sash block.

2. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.

3. Unless noted otherwise in drawings, continue reinforcing in bond beams through control joints. Rake vertical joint on each side and provide backer rod and sealant in joint.

C. Form expansion joints in brick made from clay or shale as follows:

1. Build flanges of factory-fabricated expansion joint units into masonry.

2. Build in compressible joint fillers where indicated.

3. Form open joint of width indicated but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7. Maintain joint free and clear of mortar.

D. Install nonmetallic expansion joint strips at building expansion joints.

3.15 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and wherever openings of more than 1 foot for brick-sized units and 2 feet for block-sized units are shown without structural steel or other supporting lintels. Provide precast or formed in-place masonry lintels. Cure precast lintels before handling and installing. Temporarily support formed in-place lintels.

1. For hollow concrete masonry unit walls, use specially formed bond beam units with reinforcement bars filled with coarse grout.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.16 CAVITIES/AIR SPACES

A. Keep cavities/air spaces clean of mortar droppings and other materials during construction. Strike joints facing cavities/air spaces flush. No voids are allowed.

B. Install cavity drainage material as indicated in Architectural drawings.

C. For rigid insulation, install small pads of adhesive spaced approximately one foot on-center both ways on inside face or attach to inside face with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.17

3.18 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running match existing and new.

2. Coursing: One unit and one mortar joint to equal 8 inches.

3. Mortar Joints: Concave.

D. Brick Units:

1. Bond: Match existing.

2. Coursing: Three units and three mortar joints to equal 8 inches.

3. Mortar Joints: Concave.

3.19 PLACING AND BONDING

A. General: Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in project.

1. Masonry units shall be laid true, level, plumb and in uniform coursing in accordance with drawings. Corners and angles shall be square unless otherwise indicated in drawings.

2. Lay only dry concrete masonry units. Do not wet concrete masonry units unless approved.

3. Adjust masonry units into final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove mortar, clean joints and units, and relay units with fresh mortar.

4. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual thickness of masonry units using units of nominal thickness indicated.

5. Use full-sized units without cutting where possible. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction.

B. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

C. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets.

D. Layup walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

E. Bond Pattern for Exposed Masonry: Lay exposed masonry as follows unless indicated otherwise in drawings:

1. Match Existing Bond.

2. Do not use units with less than nominal 4-inch horizontal face dimensions.

3. Avoid use of less-than-half-sized units at corners, jambs, and where possible at other locations.

4. Where indicated in drawings, match coursing, bonding, color, and texture of new masonry with existing masonry bond.

F. Lay concealed masonry with units in wythe in running bond or bonded by lapping not less than 4 inches.

1. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch- horizontal face dimensions at corners or jambs.

G. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to opening.

H. Nonbearing Interior Partitions: Build full height of story to underside of solid floor or roof structure above and as follows.

1. Install compressible filler in joint between top of partition and underside of structure above. Brace top of wall as shown in drawings.

I. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

J. Lay hollow masonry units with face shell bedding on head and bed joints.

K. Remove excess mortar and mortar smears as work progresses.

L. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

M. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

N. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

O. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

P. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

Q. Stopping and Resuming Work: In each course, rack back one-half unit length for one-half running bond or one-third unit length for one-third running bond. Do not tooth. Clean exposed surfaces of set masonry. Wet clay masonry units lightly if required. Remove loose masonry units and mortar prior to laying fresh masonry.

3.20 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally directly as shown on drawings.

3.21 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.

D. Install mortar diverter at every floor level. For wall cavities that exceed 11' in height, place an additional continuous trapezoidal strip on wall reinforcing anchors/ties at every 9' to 11' of wall height.

E. Flashing should extend at least 6" above the top of mortar diverter, as should any other materials used to fill space between mortar diverter and inside cavity surface.

F. No more than 1/4" should be left between mortar diverter and cavity’s inside surface (flashing or filler).

G. Installing Cavity-Wall Insulation:

1. For attachment to metal framing backup anchor thru insulation and sheathing into the metal stud using masonry anchors specified. Butt joints tightly both ways. Install tongue and groove panels with tongue in the up position.

    a. Seal all joints between insulation board units in cavity with joint sealing tape, to form a tight seal at all joints, including areas around masonry anchors and other openings. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

2. For attachment to masonry backup place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

3.22 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at nonmasonry construction.

2. Remove or cover protrusions or sharp edges that could puncture flashings.

3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:

C. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

D. Install flashing a minimum of 6" above cavity mortar drainage system.

3.23 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Size control joint in accordance with Section 07 9200 - Joint Sealants for sealant performance.

C. Form expansion joint as detailed on drawings.

3.24 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.25 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.26 FIRE RATED WALL MARKING AND IDENTIFICATION

A. For all masonry walls or partitions indicated to be fire rated, or smoke rated, where there is an accessible concealed floor, ceiling or attic space adjacent to said wall. Contractor shall permanently mark with signs or stenciling within he concealed space, in accordance with IBC 703.7 in concealed spaces.

1. Identifications shall be located within 15 feet of the end of each wall or partition and at intervals not exceeding 30 feet measured horizontally along the wall or partition.

2. Identifications shall include lettering not less than 3 inches in height with a minimum 3/8 inch stroke width in a contrasting color incorporating the wording " FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS".

3.27 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

E. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

F. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

G. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

H. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel un cleaned for comparison purposes. Obtain Owner's representative 's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and non masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.

5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.28 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

3.29 MASONRY WASTE DISPOSAL

A. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Shop fabricated steel items.

B. Steel framing for dunnage for mechanical equipment and miscellaneous equipment.

C. Steel framing and supports for applications where framing and supports are not specified in other Sections.

D. Loose lintel where indicated.

E. Metal nosing

1.3 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements for testing requirements and procedures.

B. Division 7 for roofing and sheet metal flashings for roof penetrations and installations associated with steel support roof framing.

C. Section 09 9123 - Interior Painting: Paint finish.

1.4 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

I. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata.

J. SSPC-SP 2 - Hand Tool Cleaning; 1982, with Editorial Revision (2004).

1.5 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For the following:

1. Miscellaneous framing for mechanical/electrical equipment.

2. Lintels

3. Metal nosing

4. Paint products.

5. Black Iron

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.

3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer, licensed in the State of NY responsible for their preparation.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of NY and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

2. Provide for trimming and fitting at site.

1.9 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate with Plumbing, Mechanical, and Electrical Contractor's equipment prefabricated equipment, curbs, portals, and conduit.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

2.2 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work

D. Fit and shop assemble items in largest practical sections, for delivery to site.

E. Fabricate items with joints tightly fitted and secured.

F. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Do not use ferrous material and equipment on stainless steel components.

3. Obtain fusion without undercut or overlap.

4. Remove welding flux immediately.

5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface

G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

H. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594

2.4 FABRICATED ITEMS

A. Abrasive Stair Nosings: Consisting of an abrasive filler bonded and locked into channels in an extruded aluminum base, alloy 6063-T6. Coefficient of friction 1.02 dry, 0.98 wet per ASTM F 609. Provide the following:

1. Tread Cast aluminum solid surface tread plate 3/8 inch thick with continuous arrow-profile anchor 3/4 inches deep.

a. 3 inches wide, lip 1/4 inch from underside.

2. Space anchors 3" from ends and 12" oc.

3. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete

4. Product: Series 200 Amstep Products, 190 Century Drive, Bristol, CT 06010, Phone: 860-589-9085; Fax: 860-589-9081; Toll Free: 800-457-0869; sales@amstep.com; www.amstep.com

5. Substitutions: See Section 01 2500 Substitution Procedures.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.7 FINISHES - STEEL

A. Refer to Section 09 9123 Interior Painting and Section 09 9113 Exterior Painting.

B. Prime paint steel items.

1. Prime paint all steel items except:

a. Galvanize items to be embedded in concrete and items to be embedded in masonry.

b. Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

C. Prepare surfaces to be primed in accordance with SSPC-SP2.

D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

E. Prime Painting: One coat.

1. Interior ferrous metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664.

2. Refer to Section Section 09 9123 Interior Painting and Section 09 9113 Exterior Painting for preparation, prime coats and finish coats for all exterior exposed ferrous metal.

F. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

1. Locations all exterior steel and as shown on drawings.

2.8 FINISHES - ALUMINUM

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick unless noted otherwise.

B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

C. For tubes set in steel outrigger provide neoprene continuous strips on all contact areas.

2.9 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.3 INSTALLATION

A. Install fabricated items as per manufacturer's instructions

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Field weld components as indicated on shop drawings.

E. Perform field welding in accordance with AWS D1.1/D1.1M.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

G. After erection, prime welds, abrasionsand surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 32 3119 - Decorative Metal Fences and Gates

1.2 SECTION INCLUDES

A. Wall mounted handrails.

B. Ramp Railing as shown on drawings.

1.3 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.

1.4 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

D. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2016.

E. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2010e1.

F. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications; 2013, with Editorial Revision (2014).

G. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Samples: Submit two, 12 inch long samples of handrail. Submit two samples of finish welding.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.

E. Designer's Qualification Statement.

F. Fabricator's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State of New York, or personnel under direct supervision of such an engineer.

1. Engineering services are defined as those performed for installations of handrails and railing systems that are similar to those indicated for this Project in material, design, and extent.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

1. AWS D1.2 Structural Welding Code – Aluminum.

C. Fabricator Qualifications:

1. A company specializing in manufacturing products specified in this section, with not less than ten years of experience in producing handrails and railing similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

2. All railings and handrails specified in this Section to be fabricated and installed by the same firm.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, handrails, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

C. Concentrated Loads: Design railing assembly, handrails, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

D. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

F. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.

1. Outside Diameter: 1-1/2" inch.

G. Dimensions: See drawings for configurations and heights.

1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.

2. Top Rails: 1-1/2 inches

3. Intermediate Rails and Wall Rails: 1-1/2 inches diameter, round.

4. Posts: 1-1/2 inches diameter, round.

H. Guards:

1. Railings: Outside diameter: 1-1/2 inch unless otherwise indicated.

I. End and Intermediate Posts: Same material and size as top rails.

1. Horizontal Spacing: As indicated on drawings.

J. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, form or core drill holes not less than 5" (127 mm) deep and 3/4' (19 mm) greater than outside diameter of post. Clean holes of loose material. Insert posts and fill annular space between post and concrete with non-metallic grout, mixed and placed to comply with anchoring material according to manufacturer's direction.

K. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

L. All aluminum rail and related components shall be powder coated. Color to be selected by architect.

2.2 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Welding Fittings: No exposed fasteners; machined aluminum.

C. Straight Splice Connectors: Concealed spigot; machined aluminum.

D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.3 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Exposed Fasteners: No exposed bolts or screws.

D. Straight Splice Connectors: Steel welding collars.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.

1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.4 BRACKETS, CONECTORS AND MISCELLANEOUS ITEMS

A. Wall Brackets: Provide wall brackets as follows:

1. Universal Weld Bracket as manufactured by Wagner Company.

a. Aluminum 3-1/4". (Powder coated)

B. Wedge-Lock Welding Connector: Wagner steel connector to align railings. Weld all joints.

C. Wall Returns: Wagner steel wall return with two (2) holes.

2.5 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. Provide complete assemblies including handrails, railings, clips, brackets other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.

2. Use connections that maintain structural value of joined pieces

B. Shop Assembly: Pre-assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

C. Accurately form components to suit specific project conditions and for proper connection to building structure.

D. Fit and shop assemble components in largest practical sizes for delivery to site.

E. Fabricate components with joints tightly fitted and secured.

F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work

G. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

H. Weld connections that cannot be shop welded due to size limitations.

1. Weld in accordance with AWS D1.1/D1.1M.

2. Match welding.

3. Clean welds and abraded areas

4. Touch up shop primer and factory-applied finishes.

5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

I. Close exposed ends of railing members with prefabricated end fittings.

J. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

L. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

2.7 ALUMINUM FINISHES

A. Powder coat all handrails and related components.

B. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's full line.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip aluminum where site welding is required. Refinish.

B. Supply items required to be cast into concrete with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and details shown on drawings.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

3.4 TOLERANCES

A. Maximum Offset From True Alignment: 1/4 inch.

B. Maximum Out-of-Position: 1/4 inch.

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Fire retardant treated wood materials.

B. Communications and electrical room mounting boards.

C. Concealed wood blocking, nailers, plywood, shims and supports for hardware, as shown on drawings, and as required.

1.3 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 7100 - Door Hardware

C. Section 12 2940 - Roller Shades.

1.4 REFERENCE STANDARDS

A. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. PS 20 - American Softwood Lumber Standard; 2015.

F. WWPA G-5 - Western Lumber Grading Rules; 2017.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on lumber, plywood, and fasteners.

C. Shop drawings, or 2 foot long on-site samples which show the size, shape, configuration and method of fastening for all wood blocking assemblies, and which show how the blocking assemblies will relate to other adjoining work.

D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

E. Material Safety Data Sheets.

1.6 QUALITY ASSURANCE

A. A firm (Installer) with not less than five (5) continuous years experience performing carpentry work comparable to that required for this project, employing personnel skilled in the work specified.

B. The Installer shall directly employ the personnel performing the work of this section.

C. The Installer shall have a full time supervisor/foreman on the roof when work is in progress. The Supervisor shall have a minimum of five (5) years experience in work similar in nature and scope to this project, and speak fluent English.

D. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Deliver and store materials dry at all times.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.8 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Refer to Section 07 5010 - Modifications to Existing Roofing for Warranty requirements.

1.9 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. Species: Douglas Fir, unless otherwise indicated, construction grade solid lumber free of splits, large knots and other imperfections.

2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.

3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Western Wood Products Association; WWPA G-5.

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: Kiln-dry or MC15.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.

2.3 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.4 ACCESSORIES

A. Fasteners and Anchors:

1. General: Provide fasteners of size and type that comply with requirements specified in this article by the authority having jurisdiction, International Building Code, International Residential Code, Wood Frame Construction manual, and National Design Specification

2. Metal and Finish: Hot-dipped galvanized steel as per ASTM A153/A153M for exterior, wet areas, wood presevative, and high humidity areas and unfinished steel for other wood locations.

3. Use screws wherever possible, minimum size diameter #12. If nails are used they shall be annular ring shank type. Do not use dry wall screws to secure wood blocking assemblies.

4. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.5 FACTORY WOOD TREATMENT

A. Fire Retardant Treatment:

1. Manufacturers:

a. Arch Wood Protection, Inc: www.wolmanizedwood.com.

b. Koppers, Inc: www.koppers.com.

2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. Do not use treated wood in direct contact with the ground.

3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

   b. Treat rough carpentry items for all interior concealed blocking.

   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Provide the following specific nonstructural framing and blocking:

   1. Cabinets and shelf supports.

   2. Wall brackets.

   3. Wall-mounted door stops.

   4. Display Case.

3.4 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.

2. Where boards are indicated or required as full floor-to-ceiling height, install with long edge of board parallel to studs.

3. Install adjacent boards without gaps.

3.5 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

3.6 CLEANING AND PROTECTION

A. General: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.

2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.

4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

SECTION 06 1010
ROOF RELATED ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. All plant, labor, materials, equipment, testing and services necessary to complete the work shown on the schedules, keynotes, drawings, as specified herein, and as may be required by conditions and including, but not limited to, the following:

1. Related wood nailers, blocking, shims, and plywood.

1.3 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation

B. Section 07 6200 - Sheet Metal Flashings and Specialties.

C. Section07 7200 - Roof Accessories

D. Section 237416 - Packaged Rooftop Air Conditioning Units. V E RI I FY W/ CONSULTS

1.4 REFERENCE STANDARDS

A. APA PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels (Form E445); 2001.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

E. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. PS 1 - Structural Plywood; 2009.

G. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2015.

H. WWPA G-5 - Western Lumber Grading Rules; 2017.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. A firm (Installer) with at least 5 continuous years experience performing carpentry work comparable to that required for this project, employing personnel skilled in the work specified.

2. The Installer shall directly employ the personnel performing the work of this section.

3. The Installer shall have a full time supervisor on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience in work similar in nature and scope to this project, and speak fluent English.

B. Pre-Construction Conference: Attend the pre-construction meeting to discuss how and when carpentry work will be performed and coordinated with other work, and how the building will be kept watertight as work occurs.

1.6 SUBMITTALS

A. Submit the following items far enough in advance to obtain approval prior to performing any work on site:

1. A pre-work site and building inspection report with photos, to document conditions before work starts.

2. Mill or Manufacturer data sheets to identify the source for each type of lumber and fastener.

3. Shop drawings or 2 foot long on-site samples which show the size, shape, configuration and method of fastening for all wood blocking assemblies, and which show how the blocking assemblies will relate to other adjoining work.

4. Simultaneously provide all technical data submittals needed for this project, for all technical sections, collated by section. Incomplete submittals will not be reviewed.

a. Submittals shall be prepared and made by the firm that will perform the actual work.

b. Provide electronic submittals in pdf format, organized in folders by Section.

B. Safety Data Sheets: Simultaneously provide all Safety Data Sheets needed for this project, for all specification sections - collated by section, in three ring binders. Provide two binders for each building to the Construction Manager.

C. Manufacturer's Certificate: Certify that wood products supplied meet or exceed specified requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials dry at all times.

1. Cover with tarps and protect against exposure to weather and contact with damp or wet surfaces.

B. Support stacked products to prevent deformation and to allow air circulation.

C. Do not overload the structure when storing material on the roof. Material stored on the roof shall be placed on 2 by 10 wooden planks, placed over 1-1/2 inch foam insulation, that is laid on a layer of 6 mil fire retardant polyethylene.

1.8 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a two (2) year period after Date of Substantial Completion.

1.9 WARRANTY

A. For roof related installations:

1. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a two (2) year period beginning upon Final Completion:

2. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, and undue expansion.

3. The Contractor's Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense.

4. The Guarantee shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to affect guaranteed repairs.

5. The Contractor's Guarantee shall be issued no more than 30 days before the satisfactory completion of punch list work.

B. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Wood, including shims, nailers, blocking, furring and similar members, in the sizes indicated, worked into the shapes shown, and as follows:

1. Lumber: Douglas Fir dimension lumber, free of large knots and other imperfections. Kiln Dried.

2. Plywood: Exterior grade APA rated Type CDX underlayment plywood.

3. Beveled Siding: Utility grade cedar, redwood, or synthetic siding, 1/2 inch by 6 inches and 3/4 inch by 10 inches wide, tapered to 1/8 inch thick.

B. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

1. Material Quality: Obtain each type of material from a single source to ensure consistent quality, color, pattern, and texture.

2. Pre-Work Conference: Attend the pre-roofing meeting to discuss how carpentry work will be performed and coordinated with other work.

C. Lumber fabricated from old growth timber is not permitted.

D. Metal including light gage metal channels and studs shall be factory formed of minimum 20 gauge cold, unless otherwise noted, formed galvanized steel.

E. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.

1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

2. Treat lumber in contact with roofing, flashing, or masonry.

2.2 FASTENERS

A. Hot dipped galvanized steel, stainless steel, or steel covered with a proprietary rust inhibiting coating.

B. Use screws wherever possible, minimum size diameter #12. If nails are used they shall be annular ring shank type. Do not use dry wall screws to secure wood blocking assemblies.

C. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, galvanized elsewhere.

1. Do not use drywall screws to secure wood blocking assemblies. Remove and replace carpentry components installed with drywall screws.

2.3 ACCESSORIES

A. Batt Insulation: un-faced fiberglass insulation, minimum thickness 6 inches, R=30, as needed to fill the metal stud framing.

B. Polyethylene: 6 mil thick fire retardant polyethylene sheeting.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Coordinate carpentry work with the installation of the roofing system, insulation, flashings, and other similar items.

B. Shim and set carpentry work plumb and true, except provide slope at the top surfaces of horizontal members as indicated.

C. Stagger joints in built up assemblies at least 2 feet to obtain maximum strength. Provide the appropriate shapes needed and adjust wood members to suit existing conditions for full bearing and secure attachment. Discard defective material, and pieces which are too small, and fabricate the work with a minimum of joints and an optimum joint arrangement.

D. Securely attach carpentry work to resist a pull of 275 pounds per lineal foot in any direction. Countersink all fasteners flush unless otherwise shown.

E. Blocking used for the attachment of roof assembly and flashing shall be dry prior to roof or flashing is installed.

F. Space fasteners to achieve adequate holding power, generally as follows:

1. Anchor bolts embedded in concrete, drilled anchors into concrete or masonry, screws into a steel deck or structural steel member, or screws into wood framing: 12 inches on center.

2. Nails into wood: 8 inches on center.

3. Install two rows of fasteners on blocking wider than 5 inches.

G. Fit carpentry work neatly scribed and cut to fit within 1/8 inch of adjoining materials. Position furring, nailers, blocking, shims and similar supports for the proper attachment of subsequent work.

H. Fasten wood blocking assemblies to metal decks with #12 screws. Pre-drill holes as needed. .

3.2 CLEANING, PROTECTION AND WATERTIGHTNESS

A. Contractor shall inspect the interior and exterior of the building and grounds, and submit a written report with photos to document any leaks or damage, prior to performing any work.

B. The Construction Manager will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leaks or damage which was not documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.

C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.

D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather which may occur unexpectedly. Make all work areas watertight at the end of each day's work.

E. Frequently clean up all refuse, rubbish, scrap materials and debris so the work site presents a neat, orderly and workmanlike appearance.

F. Carefully clean the roof to remove all residual debris when work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

3.3 WASTE DISPOSAL

A. Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.

B. Comply with applicable regulations.

C. Do not burn scrap on project site.

D. Do not burn scraps that have been pressure treated.

E. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

SECTION 07 5010
MODIFICATIONS TO EXISTING ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Modification to existing EPDM membrane roofing system.

1. The HVAC, Plumbing, and Electrical Contractor shall coordinate, provide and be responsible for their equipment and locations.

B. The existing roof is under warranty. Coordinate with Construction Manager for further information.

1. Contractor must notify and be authorized by the manufacturer to perform all work as per the manufacturer's instruction.

2. Obtain copy of existing warranty from the owner.

C. All Prime Contractor(s) shall remove thier own equipment

D. Remove all existing membrane, insulation, flashings, curbs, cover boards, vapor barrier, and dunnage as required to provide and install new openings, mechanical equipment, connection to existing roofing, curbs, dunnage, and portals as shown on drawings.

E. Cut new openings and install curbs.

F. Disposal of removal and debris construction waste and dispose in manner complying with all applicable federal, state, and local regulations.

G. Install new isocyanurate insulation, cover board, fully adhered 60 mil thick fire rated EPDM roofing, and flashings as indicated or required.

H. Clean all residual material from substrate surfaces and the flutes of any exposed steel deck - prior to installing new insulation and roofing. Install new insulation, roofing and flashings only on dry smooth surfaces.

I. Abandoned mechanical equipment and support curbs will be removed by the mechanical contractors.

J. Maintain building watertight at all times.

K. Install new support steel and decking; insulation to finish flush with existing the deck substrate, new insulation and roofing to make the building permanently watertight.

L. Comply with the published recommendations and instructions of the roofing membrane manufacturer.

M. Commencement of work shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty

acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

1.3 RELATED REQUIREMENTS

A. Section 06 1010 - Roof Related Rough Carpentry Wood nailers associated with roofing and roof insulation.

B. Section 07 6200 - Sheet Metal Flashings and Specialties.

C. Section 07 7200 - Roof Accessories

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 for definition of terms related to roofing work not otherwise defined in the section.

1.5 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.

B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2018a.

D. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing; 2016.

E. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

G. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2016.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Before start of roofing work, General Construction Contractor and Installer shall hold a meeting to discuss the proper installation of materials, status of the existing warranty and requirements to maintain the existing warranty.

1. Notify Owner's Representative well in advance of meeting.

2. Review all locations required for modifications to existing roofing.

1.7 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Provide manufacturer's printed data sufficient to show that all components of roofing systems, including insulation and fasteners, comply with the specified requirements and with the roofing manufacturer's requirements and recommendations for the system type specified; include at least the following:

    a. Technical data sheet for roof membrane.

    b. Technical data sheets for splice tape and adhesives.

    c. Technical data sheet for each insulation type.

    d. Technical data sheet for each cover board type.

    e. Technical data sheet for pavers.

2. Written certification from the existing roofing manufacturer which states that the installer is acceptable or licensed to install or modify the existing roofing system, and that the warranty will remina in effect; if not previously provided.

C. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications for all systems under warranty.

1.8 CODE APPROVAL REQUIREMENTS

A. Install roofing and insulation system components to meet the following minimum requirements:

1. New York State Uniform Fire Prevention and Building Code, which includes by reference the New York State Energy Conservation Code.

2. Underwriters Laboratories Inc. Class A External Fire Rating for roof assemblies tested in accordance with ASTM E 108 or UL 790.

3. Minimum wind uplift pressure calculated using ASCE 7 and a safety factor of 2:

    a. Field Zone - 90 psf

    b. Perimeter Zones - 135 psf

    c. Corner Zone - 180 psf

B. Provide written certification from the roof material Manufacturer, before beginning work, to confirm the roofing system meets these requirements.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty (20) years of documented experience.

B. Installer Qualifications: Roofing installer shall have the following:

1. A firm (Installer) with not less than five (5) continuous years experience performing EPDM roofing work similar to that required for this project, employing personnel skilled in the specified work.

2. The Installer shall directly employ the personnel performing the work of this section.

3. The Installer shall have a full time supervisor/foreman on the roof when roofing work is in progress. The Supervisor shall have a minimum of five (5) years experience in roofing work similar in nature and scope to this project, and speak fluent English.

4. The Installer shall provide a reference list of at least three projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner's Representative.

5. The Installer shall be acceptable to or licensed by the Manufacturer of the primary roofing materials, and provide written certification from the Manufacturer to confirm this prior to award if requested.

C. Material Quality: Obtain each product, including the insulation, cover board, EPDM roofing and flashing, and cements, primers and adhesives produced by a single Manufacturer, which has manufactured the same products in the United States of America for not less than five (5) continuous years.

1.10 JOB CONDITIONS (CAUTIONS & WARNINGS)

A. Do not use oil base or plastic roof cement with EPDM roofing. Do not allow waste products, (petroleum grease or oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with any roofing, insulation or flashing product. Do not expose EPDM roofing and accessories to a temperature in excess of 175 degrees Fahrenheit.

B. Splice cleaner, primer, cements and bonding adhesives are flammable. Do not breathe vapors or use near fire or flame or in a confined or unventilated area. Dispense only from a UL listed or approved safety can.

C. Remove empty adhesive and solvent containers and contaminated rags from the roof and legally dispose of them daily.

D. Do not apply adhesives adjacent to open ventilation system louvers, or windows. Temporarily cover the louvers and windows with 6 mil fire retardant polyethylene and prevent adhesive odors from entering the building. Remove temporary covers at the end of each days work.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to the site in the Manufacturer's original and unopened packaging, bearing labels which identify the type and names of the products and Manufacturers, with the labels intact and legible.

B. Store all materials in accordance to manufacturer's instructions.

C. Cover all stored materials, except rolls of EPDM and sealed cans of adhesives, with watertight tarpaulins installed immediately upon delivery.

D. Immediately remove any insulation which gets wet from the job site.

E. Do not overload the structure when storing materials on the roof.

F. Store and install all material within the Manufacturer's recommended temperature range.

1.12 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Existing Roof System Under Warranty

1. The existing roofing system is under warranty and the General Construction Contractor or their subcontractor must notify and be authorized by the manufacturer to perform all work as per the manufacturer's instruction.

a. Manufacture's Warranty: Certification from manufacturer that the existing warranty covering membrane, roof insulation, and other indicated components of the system, shall remain the new and existing terms of the original warranty.

2. Comply with all warranty procedures required by manufacturer, including notifications Manufacture's Warranty: Certification from manufacturer that the existing warranty covering membrane, roof insulation, and other indicated components of the system, shall remain the new and existing terms of the original warranty, scheduling, and inspections:

3. Manufacturer's and Contractor's Guarantees/Warranties shall be issued no more than 30 days before the satisfactory completion of punch list work.

PART 2 PRODUCTS

2.1 GENERAL

A. Acceptable Manufacturer - Roofing System: Match existing manufacturers roofing system.

1. Roofing systems by other manufacturers are not acceptable if existing roof is under warranty.

B. Substitutions: See Section 01 2500 - Substitution Procedures

2.2 EPDM ROOFING

A. Unreinforced 60 mils thick, fire retardant, EPDM (Ethylene Propylene Diene Monomer) sheet membrane conforming to the following minimum physical properties.

	PROPERTY	TEST METHOD	SPECIFICATION
2.	Color-		Gray/Black
3.	Elongation	ASTM D-412	300% min
4.	Tear Strength	ASTM D-624	150 lb/in min
5.	Ozone Resistance	ASTM D-1149	No cracks, 7 days/100 pphm/100ºF/50% strain
6.	Heat Aging	ASTM D-573	1200 psi min@ 200% elongation/4 wks/240ºF
7.	Brittleness Temperature	ASTM D-746	-49ºF

8. Water Vapor Permanence ASTM E-96 2.0 perm max

9. Thickness ASTM D-412 60 mils plus/minus 6 mils

10. Fire Retardant UL Class A

B. Related Materials:

1. Cleaners, adhesives, sealants, caulking and fasteners furnished by the EPDM system Manufacturer. Use low VOC adhesives and cleaners to comply with regulations in effect at the time of application.

a. Stripping: 90 mil thick 5 inch and 9 inch wide self adhering flashing, consisting of 45 mils of semi-cured EPDM factory laminated to 45 mils of cured seaming tape.

b. Bonding Adhesive: High strength contact adhesive.

c. Splice Adhesive: High strength synthetic polymer based contact cement formulated specifically to splice EPDM sheets.

d. Lap Sealant: EPDM rubber based gun grade sealant.

e. Water Block Seal: One component low viscosity butyl rubber sealant.

f. Pre-Molded Pipe Flashing: Pressure sensitive prefabricated flashings with pre-applied adhesive.

g. Pourable Sealer: Two component, solvent free polyurethane based sealant.

h. Reinforced Perimeter Fastening Strips: 030 inch thick reinforced cured EPDM.

i. Seam Tape Primer: Synthetic rubber polymer based primer designed to clean and prime seam tape spice areas prior to installing the tape.

j. Seam Splice Tape: Nominal 30 mil thick cured polymer self adhesive tape with release paper carrier, 6 inches wide.

k. Plates and Bars: Galvanized and corrosion resistant specialty products.

l. Fasteners: #14 Fluorocarbon polymer coated heavy duty screws.

C. Gypsum Cover Board: 1/4 inch thick fire resistant gypsum board decking with inorganic glass mat facers and a water resistant core, formulated in 48 x 48 inch square edge boards, UL Class A, meeting ASTM C-1177, manufactured under the trade name Dens-Deck Prime

2.3 INSULATION:

A. Isocyanurate – Tapered rigid cellular polyisocyanurate boards with fibrous felt/fiberglass mat facers, sloping 1/8 inch per foot, (match existing) minimum starting thickness 1-1/2 inches, minimum compressive strength 20 psi, meeting ASTM C1289-01, Type II, Class1, Grade 2.

1. Crickets sloping 1/4 inch per foot.

2. At repairs to existing building match thickness of existing insulation.

3. Product: Firestone “ISO 95+ Isocyanurate Insulation” or approved equal.

2.4 ACCESSORY MATERIALS

A. Roof Deck: Non-composite type, fluted steel sheet:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

2. Minimum Base Metal Thickness: Match existing.

3. Nominal Height: Match existing.

4. Side Joints: Lapped, mechanically fastened.

5. End Joints: Lapped, mechanically fastened.

B. Rubber Walkway Pads: 30" x 30"x 1/4". Compatible with existing roofing system.

C. Concrete Pavers: Interlocking, with shiplap edges on all sides and integral radiused bearing pads.

1. Size: Approximately 30 inches by 30 inches by 1-1/2 inches thick.

PART 3 INSTALLATION

3.1 GENERAL

A. Construct the new roofing system in a watertight, workmanlike manner, meeting the guarantee requirements specified herein; in strict accordance with the drawings and in conformance with the Manufacturer's requirements, except as enhanced in this specification.

B. Clean the surface on which roofing system components will be applied, of all laitance, dirt, oil, grease or other foreign matter which would in any way affect the quality of the installation.

C. Install roof system components on dry surfaces only. Do not install any items when weather conditions and outside temperatures are not suitable in accordance with the Manufacturer's recommendations.

D. Complete all work in sequence as quickly as possible so that as small an area as practicable is in the process of construction at any one time. Complete the entire area of work begun each day, the same day, and make all exposed edges watertight at the end of each day's work.

3.2 SUBSTRATE INSPECTION

A. Remove portions of existing roofing, insulation, and flashings, and carefully check the existing deck and new roof substrate. To be an acceptable surface for the new roofing system, the deck and substrate shall be well secured to the underlying structure, dry and not otherwise deteriorated.

B. Immediately notify the Owner's Representative in writing if defects in the substrate are discovered.

C. Maintain the building watertight in the interim, but do not install new insulation or roofing until substrate defects have been corrected.

3.3 NEW TO EXISTING INTERFACE

A. Remove and replace portions of existing roofing at the construction interface between new construction and existing roof areas.

1. Install new isocyanurate insulation, mechanically fastened, to match existing insulation thickness and to maintain the slope of the existing insulation.

2. Install 60 mil. fully adhered EPDM membrane to lap a minimum of 12 inches onto existing EPDM membrane.

3.4 INSULATION AND COVER BOARD

A. Install tapered insulation and crickets, neatly cut at all miters and transitions.

1. Do not lace corner boards.

2. Install the crickets under the new insulation

B. Install insulation with joints offset between rows and layers a minimum of 12 inches. Cut insulation to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.

C. Fasten new and replacement layers of insulation with screws and discs which penetrate through the deck a minimum of 3/4 inch and a maximum of 1-1/2 inches.

1. Provide number of fasteners as recommended by the manufacturer or the equivalent of:

a. Install 16 fasteners per 4 by 8 foot insulation board in the field of the roof.

b. Install 28 fasteners per 4 by 8 foot insulation board in 12 foot wide perimeter zones.

c. Install 32 fasteners per 4 by 8 foot insulation board in 12 foot square corner zones.

2. Carefully choose the length and position of each screw to ensure the screws do not protrude through the underside of the deck where visible inside the school.

D. Install gypsum cover board over the insulation with joints offset between rows and the insulation a minimum of 12 inches. Cut gypsum cover board to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.

E. Install all layers of insulation on deck areas and the gypsum cover board, in low rise polyurethane foam adhesive applied in accordance with the Manufacturer's recommendations and to achieve the specified minimum uplift resistance.

1. Install 1/2 inch diameter adhesive beads spaced 12 inches on center in the field of the roof.

2. Install 1/2 inch diameter adhesive beads spaced 6 inches on center in 12 foot wide perimeter zones.

3. Install 1/2 inch diameter adhesive beads spaced 4 inches on center in 12 foot square corner zones.

3.5 PREPARATION

A. Remove all of the existing roof system down to the roof deck including all existing composition base flashings. Dispose of all materials properly. Perform asbestos removal in accordance with federal, state and local regulations and dispose of waste in legal manner.

1. At penetrations, remove all existing flashings, including lead, asphalt, mastic, etc.

2. At walls, curbs, and other vertical and sloped surfaces, remove loose and unsecured flashings; remove mineral surfaced and coated flashings; remove excessive asphalt to provide a smooth, sound surface for new flashings.

B. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

C. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

D. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.

E. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.6 VAPOR RETARDER

A. Before installing insulation install vapor retarder directly over the deck to match existing, if present.

B. Ensure that all penetrations and edge conditions are sealed to prevent moisture and air drive into the roofing system.

3.7 INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install insulation in a manner that will not compromise the vapor retarder integrity.

C. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.

D. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by membrane manufacturer.

3.8 SINGLE-PLY MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Install membrane adhered to the substrate, with edge securement as specified.

E. Fully adhere EPDM to the substrate with bonding adhesive, .

1. Allow contact bonding adhesive to dry to the touch EPDM before joining the EPDM to the substrate. Roll the EPDM onto the bonding adhesive and immediately rub it vigorously with a soft bristle broom to ensure complete adhesion.

2. Do not punch holes in cans of adhesive and use them in a “Better Spreader” without first opening the cans to mix them.

3. Replace used roller covers each day; discard covers after each days use.

4. Allow bonding adhesive to dry to the touch before joining the PVC to the substrate.

5. Allow bonding adhesive to dry to the touch before joining the EPDM to the substrate.

F. Roofing installed over improperly applied adhesive or with adhesive that wasn't stirred, and roofing installed with blisters, ridges, mole runs and similar deficiencies shall be removed and replaced at the Contractor’s expense

G. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.

H. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.

3.9 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls and curbs and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing high above membrane surface or as shown on drawings.

1. Use the longest practical flashing pieces.

2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.

3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.

4. Provide termination directly to the vertical substrate as shown on roof drawings.

C. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.

1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.

2. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a standard curb with flashing.

3.10 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

B. Walkway Pads: Adhere to the roofing membrane, with five full strips of adhesive tape, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.

1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.

2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.11 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

B. Perform all corrections necessary for issuance of warranty.

3.12 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.13 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

SECTION 07 5235
ELASTOMERIC MEMBRANE DUCT WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Elastomeric roofing membrane, adhered conventional application to gypsum sheathing and rigid insulation duct enclosure.

B. Flashings.

C. Insulation

1.3 RELATED REQUIREMENTS

A. Section 01732 Construction Waste Management and Disposal for material re-use and/or disposal

B. Section 01616 Volatile Organic Compound (Voc) Content Restrictions

C. Section 07550 - Modified Bitumen Membrane Roofing.

D. Section 07620 - Sheet Metal Flashing and Trim: Counter flashings.

1.4 REFERENCE STANDARDS

A. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2006.

B. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers- Tension; 2006a.

C. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2007).

D. ASTM D 4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2004.

E. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

F. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

G. UL (RMSD) - Roofing Materials and Systems Directory; Underwriters Laboratories Inc.; current edition.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of associated counterflashings installed under other sections.

B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; the full time supervisor-foreman the, Architect, Owner, roofing system Manufacturer's representative, and other representatives concerned about the installation to review preparation and installation procedures and coordination and scheduling necessary for related work. Items to be discussed, include the following:

1. Commercial practice and the Manufacturer's instructions for handling and use of materials.

2. Submittals, both completed and yet to be completed.

3. A schedule for Manufacturer and Architect inspections.

4. Expected weather conditions, and procedures for coping with unfavorable weather

1.6 SUBMITTALS

A. Product Data: Provide data indicating membrane materials, flashing materials, surfacing, and fasteners.

B. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.

C. Samples of the Contractor's and Manufacturer's guarantee/warranty forms.

D. Material Safety Data Sheets VOC data: Submit MSDS highlighting VOC limits

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Westchester County's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience, providing primary products, including roof membrane, insulation, fasteners, flashing, and adhesives, produced by a single Manufacturer. Provide secondary products only as recommended by the Manufacturer of the primary products.

C. Applicator (Installer) Qualifications: Company specializing in installing roofing systems similar to that required for this project. with minimum five years experience and approved by manufacturer.

1. The Installer shall provide a reference list of at least five projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Architect and/or Owner:

2. The Installer shall directly employ the personnel performing the work of this section.

3. The Installer shall be acceptable to or licensed by the Manufacturer of the primary roofing products.

4. Installer's Field Supervision: Maintain a full time supervisor-foreman on the roof when roofing work is in progress. The supervisor shall have a minimum of 5 years experience installing EPDM roofing, and speak fluent English.

1.8 CODE APPROVAL

A. Install system components to meet the following minimum requirements:

1. New York State Uniform Fire Prevention and Building Code.

2. Underwriters Laboratories Inc. Class A fire rating for Roof Covering Materials.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Store and install all material within the Manufacturer's recommended temperature range.

1.10 FIELD CONDITIONS

A. Do not use oil base or plastic roof cement with EPDM roofing. Do not allow waste products, (petroleum grease or oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with any roofing, insulation or flashing product. Do not expose membrane and accessories to a temperature in excess of 175 degrees Fahrenheit.

B. Protect EPDM material from adjacent roofing materials.

C. Splice cleaner, primer, cements and bonding adhesives are flammable. Do not breathe vapors or use near fire or flame or in a confined or unventilated area. Dispense only from a UL listed or approved safety can.

D. Remove empty adhesive and solvent containers and contaminated rags from the roof and legally dispose of them daily.

E. Do not apply adhesives adjacent to open ventilation system louvers, or windows. Temporarily cover the louvers and windows with 6 mil fire retardant polyethylene and prevent adhesive odors from entering the building. Remove temporary covers at the end of each day's work

F. Do not apply membrane during unsuitable weather.

G. Do not apply membrane when ambient temperature is below 40 degrees F.

H. Do not apply membrane to damp or frozen surface or when precipitation is expected or occurring.

1.11 WARRANTY

A. Correct defective Work within a two year period after Date of Substantial Completion.

B. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion.

1. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, and undue expansion.

C. The Manufacturer's and the Contractor's Guarantees/Warranties shall provide that the Manufacturer and Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at their own expense.

D. Manufacturer's and Contractor's Guarantees/Warranties shall be issued no more than 30 days before the satisfactory completion of punch list work.

1.12 SUBSTITUTIONS

A. Refer Section 01600.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. EPDM Membrane Materials:

1. Carlisle SynTec: www.carlisle-syntec.com.

2. Firestone Building Products Co: www.firestonebpco.com.

3. SynTec Rubber Corporation info@syntexrubber.com.

2.2 MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); non-reinforced; complying with minimum properties of ASTM D 4637.

1. Thickness: 0.060 inch.

2. Color: grey/black.

3. Tensile Strength: 1305 psi, measured in accordance with ASTM D 412.

4. Ultimate Elongation: 300 percent, measured in accordance with ASTM D412.

5. Tear Strength: 150 lbf/in, measured in accordance with ASTM D 624.

6. Water Vapor Permeability: 2.0 per inch, measured in accordance with ASTM E 96/E 96M.

7. Brittleness Temperature: -49 deg F., measured in accordance with ASTM D 746.

8. Ozone Resistance: ASTM D-1149 No cracks,7 days/100 pphm/100ºF/50% strain

9. Heat Aging: ASTM D-573 1200 psi min@ 200%

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Fasteners: As recommended by membrane manufacturer

D. Stripping: 90 mil thick 5 inch and 9 inch wide self adhering flashing, consisting of 45 mils of semi-cured EPDM factory laminated to 45 mils of cured seaming tape.

E. Bonding Adhesive: High strength neoprene based contact adhesive.

F. Splice Adhesive: High strength synthetic polymer based contact cement formulated specifically to splice EPDM sheets.

G. Lap Sealant: EPDM rubber based gun grade sealant.

H. Pourable Sealer: Two component, solvent free polyurethane based sealant.

I. Reinforced Perimeter Fastening Strips: 0.045 inch thick reinforced cured EPDM.

J. Seam Tape Primer: Synthetic rubber polymer based primer designed to clean and prime seam tape spice areas prior to installing the tape.

K. Seam Splice Tape: Nominal 30 mil thick cured polymer self adhesive tape with release paper carrier, 7 inches wide.

L. Plates and Bars: Galvanized and corrosion resistant specialty products.

M. Fasteners: Provide fasteners that meet the specified wind uplift requirements, and as recommended by the roofing system manufacturer suitable for fastening into the existing decks.

2.3 SHEATHING

A. Deck Sheathing: Glass mat faced gypsum panels, ASTM C 1177/C 1177M, fire resistant type, 5/8 inch thick.

2.4 INSULATION

A. Isocyanurate - Rigid cellular polyisocyanurate boards with fibrous felt/fiberglass mat facers, sloping 1/8, and 1/4 and inch per foot, minimum starting thickness as indicated on the drawings, minimum compressive strength 20 psi, meeting ASTM C1289-01, Type II, Class1, Grade 2, as manufactured by Johns Manville under the trade name of “E'NRG'Y 3”.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C 655; friction fit.

1. Flame Spread Index: 25 or less.

2. Smoke Developed Index: 450 or less,

3. Formaldehyde Content: Zero.

4. Thermal Resistance: R of 19.

5. Thickness: 6 inch.

6. Manufacturers: CertainTeed Corporation: www.certainteed.com <http://www.certainteed.com>. Or equal

2.5 ACCESSORIES

A. Membrane Adhesive: As recommended by membrane manufacturer.

B. Sealants: As recommended by membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify surface is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

3.2 SUBSTRATE INSPECTION

A. Immediately notify the Architect and Owner in writing if defects in the substrate are discovered.

3.3 MEMBRANE APPLICATION

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Fully Adhered Application: Apply adhesive to substrate at rate of 1.5 gal/square. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

1. Allow bonding adhesive to dry to the touch before joining EPDM to substrate. Roll the EPDM onto the dried bonding adhesive and immediately rub it vigorously with a soft bristle broom to ensure complete adhesion

C. Overlap edges and ends and seal seams by contact adhesive, minimum 8 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

D. Mechanical Attachment: Apply membrane and mechanical attachment devices in accordance with manufacturer's instructions.

3.4 SPLICING

A. Form all membrane splices with 7 inch wide seam tape.

B. Fold the top sheet back about 10 inches. Clean both mating surfaces using clean rags with splice wash.

C. Scrub a smooth coat of QuickPrime to both mating surfaces, with long strokes obtaining complete coverage, using approximately 1 gallon per 225 square. Do not allow the QuickPrime to glop, streak or puddle. Allow it to dry to the touch before installing the seam tape.

D. Install the seam tape on the bottom sheet of EPDM membrane, using guide marks to position it so 1/8 inch minimum and 1/2 inch maximum will be exposed out of the seam when the seam is complete.

E. Roll and allow the top sheet to fall freely into place without stretching or wrinkling it.

F. Pull the splice tape release paper from within the seam area and neatly mate the seam using hand pressure to rub the membrane together.

G. Immediately roll the splice with a 2 inch wide roller, using positive pressure, toward the outer edge of splice.

H. Install uncured EPDM surface patches with rounded corners, over all T-Seam intersections.

I. Install 5 inch uncured EPDM stripping over any seam where the tape is exposed less than 1/8 inch or more than 1/2 inch.

3.5 FLASHING

A. Refer to Section 07-6200 “Sheet Metal Flashings”.

3.6 FIELD QUALITY CONTROL

A. Require site attendance of material manufacturers during installation of the Work as follows:

1. First inspection during the first day of membrane installation.

2. Final inspection at the completion of all work.

B. Provide 48 hours advance written notice to the Architect, so he may have a representative attend the inspections

3.7 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.8 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

SECTION 07 5323
EPDM ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

1.2 DESCRIPTION OF WORK

A. Install a new fully adhered unreinforced 60 mil thick EPDM roofing system, including insulation, a cover board, flashing, stripping and related accessories.

B. Install new flashings at the roof drains, and all roof-mounted and roof-penetrating equipment.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. VOC Content Restrictions -Section 01 6116

B. Roof Related Rough Carpentry - Section 06 1010

C. Sheet Metal Flashing & Specialties - Section 07 6200

D. Roof Accessories - Section 07 7200

1.4 CODE APPROVAL REQUIREMENTS

A. Install roofing and insulation system components to meet the following minimum requirements:

1. New York State Building Code.

2. Underwriters Laboratories Inc. Class A fire rating for Roof Covering Materials.

3. ASCE 7-05 minimum uplift resistance, calculated using a safety factor of 2:

a. Field Zone- 60 psf

b. Perimeter Zones – 100 psf

c. Corner Zone - 150 psf

B. Provide written certification from the Manufacturer, before beginning work, to confirm the roofing system meets these requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. A firm (Installer) with at least 5 continuous years experience performing EPDM roofing work similar to that required for this project, employing personnel skilled in the specified work.

a. The Installer shall directly employ the personnel performing the work of this section.

b. The Installer shall have a full time supervisor/foreman on the roof when roofing work is in progress. The Supervisor shall have a minimum of 5 years experience in roofing work similar in nature and scope to this project, and speak fluent English.

2. The Installer shall provide a reference list of at least three projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:

a. The reference list shall include the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.

b. The Installer shall provide the reference list prior to contract award if requested.

3. The Installer shall be acceptable to or licensed by the Manufacturer of the primary roofing materials, and provide written certification from the Manufacturer to confirm this prior to award if requested.

B. Material Quality: Obtain each product, including the insulation, cover board, EPDM roofing and flashing, and the cements, primers and adhesives from a single Manufacturer, which has manufactured the same products in the United States of America for not less than 5 continuous years.

C. Pre-Work Conference: Meet at the project site approximately one week prior to starting work, with the Architect, Owner and other representatives concerned about the work, to discuss the following:

1. How the building will be kept watertight as old roofing is removed and the work progresses.

2. How new roofing will be coordinated with the installation of the insulation, cover board, flashings and other items to provide a watertight installation.

3. Generally accepted industry practice, the Manufacturer's instructions for handling and installing his products, and specified work requirements.

4. The condition of the substrate (deck), curbs, penetrations and other preparatory work needed.

5. Submittals, both completed and yet to be completed.

6. The construction schedule, forecast weather, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.

7. A schedule for Manufacturer and Architect inspections.

1.6 SUBMITTALS

A. Submit the following items far enough in advance to obtain approval prior to performing any work:

1. Pre-work site and building inspection report with photos to document conditions before work starts.

2. Written certification from the Manufacturer which states that the Installer is acceptable or licensed to install the specified roofing; if not previously provided.

3. Manufacturer's installation instructions and technical data sheets for each component of the roofing system. Material sample submittals are not needed or wanted.

4. Samples of the Contractor's and Manufacturer's guarantee/warranty forms.

5. Material Safety Data Sheets.

B. Simultaneously provide all Material Safety Data Sheets needed for this project, for all specification sections - collated by section, in three ring binders. Provide two binders, delivered to the site. Do not submit MSDS as part of technical submittals.

C. Simultaneously provide all technical submittals needed for this project, for all technical sections, collated by section.

1. Technical submittals shall be prepared and made by the firm that will perform the actual work.

2. Provide data submittal of all products intended to be used on the project.

D. Payment requisitions will not be processed until all submittals are received and approved.

1.7 JOB CONDITIONS (CAUTIONS & WARNINGS)

A. Do not use oil base or plastic roof cement with EPDM roofing. Do not allow waste products, (petroleum grease or oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with any roofing, insulation or flashing product. Do not expose EPDM roofing and accessories to a temperature in excess of 175 degrees Fahrenheit.

B. Splice cleaner, primer, cements and bonding adhesives are flammable. Do not breathe vapors or use near fire or flame or in a confined or unventilated area. Dispense only from a UL listed or approved safety can.

C. Remove empty adhesive and solvent containers and contaminated rags from the roof and legally dispose of them daily.

D. Do not apply adhesives adjacent to open ventilation system intake openings, louvers, or windows. Temporarily cover the openings, louvers and windows with 6 mil fire retardant polyethylene and prevent odors from entering the building. Remove temporary covers at the end of each days work.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to the site in the Manufacturer's original and unopened packaging, bearing labels which identify the products and Manufacturers, with the labels intact and legible.

B. Cover all stored materials, except rolls of EPDM and sealed cans of adhesives, with watertight tarpaulins installed immediately upon delivery.

C. Immediately remove any insulation which gets wet from the job site.

D. Do not overload the structure when storing materials on the roof.

E. Store and install all material within the Manufacturer's recommended temperature range.

1.9 GUARANTEE/WARRANTY

A. Provide a written Manufacturer's "Full System Guarantee/Warranty" which warrants that the roofing system, including the insulation, cover board, EPDM roofing and flashings, will remain in a watertight condition for a twenty year period beginning upon Final Completion.

1. Guarantee/Warranty coverage shall remain in effect for gust wind speeds up to 72 miles per hour, measured at ground level at the site.

2. Guarantee and Warranty coverage shall have no dollar value limit.

B. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:

1. Defective work includes but is not limited to the following types of failure: leakage, adhesive separation, delamination, lifting, loosening, splitting, cracking, and undue expansion.

2. The Contractor's Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense:

3. The Guarantee shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to affect guaranteed repairs.

C. Manufacturer's and Contractor's Guarantees/Warranties shall be issued no more than 30 days before the satisfactory completion of punch list work.

D. Provide one Contractor’s Guarantee that covers “all work performed” when a single trade contract is awarded for work specified in multiple Sections.

E. Guarantees/Warranties shall include the removal and replacement of items or materials installed as part of the original work, if removal is needed to make warranty repairs.

F. Guarantee/Warranty coverage may be cancelled, for the affected portion of the roof, if the work is damaged by winds in excess of 72 mph, by hail, lightning, insects or animals, by failure of the structural substrate, by exposure to harmful chemicals, by other trades on the roof, or by vandalism, or if the Owner fails to maintain the roof in accordance with, or makes roof alterations contrary to, the Manufacturer’s printed recommendations.

G. Guarantee/Warranty coverage shall be reinstated, for the remainder of the original period; if the Owner restores the roof to the condition it was in prior to the damage occurring.

H. The Contractor’s Surety Company may add a rider to the Performance Bond which clarifies that Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor’s Guarantee.

1.10 SUBSTITUTIONS

A. The following factors will be considered when evaluating a possible alternative to the roofing system specified:

1. The wording and intent of the warranty to be issued.

2. The financial status, numbers of years in business, and stability of the entity that will issue the warranty.

3. A reference list of at least five completed similar projects of comparable size, with a successful functional history of at least five years, within an approximate fifty mile radius of the Project.

4. Technical aspects of the system, especially relating to durability, serviceability and performance.

5. The capacity and history of the Manufacturer in providing technical response, on-site inspections and assistance.

6. The availability and prior experience of local authorized applicators to install and maintain the proposed alternate system.

7. The willingness and history of the Manufacturer in responding to warranty claims previously made by the Owner, Architect or any Consultant involved in this project.

PART 2 PRODUCTS

2.1 PRODUCTS

A. EPDM roof system components are specified as products of Firestone Building Products Company to establish a standard of quality. Equal products and systems from Carlisle SynTec/Versico will be accepted.

B. Primary products required for this project include:

1. Roof insulation

2. Cover board

3. EPDM roofing

4. Primers and adhesives

5. Sealants

6. EPDM flashing

7. Fasteners

8. Vapor Barriers

2.2 EPDM

A. Unreinforced 60 mils thick, fire retardant, EPDM (Ethylene Propylene Diene Monomer) sheet membrane conforming to the following minimum physical properties.

PROPERTY	TEST METHOD	SPECIFICATION
Color		Gray/Black
Tensile Strength	ASTM D-412	1305 psi min.

Elongation	ASTM D-412	300% min
Tear Strength	ASTM D-624	150 lb/in min
Ozone Resistance	ASTM D-1149	No cracks,7 days/100 pphm/100ºF/50% strain
Heat Aging	ASTM D-573	1200 psi min@ 200% elongation/4 wks/240ºF
Brittleness Temperature	ASTM D-746	-49ºF
Water Vapor Permanence	ASTM E-96	2.0 perm max
Thickness	ASTM D-412	60 mils plus/minus 6 mils
Fire Retardant	UL Class A	

2.3 RELATED MATERIALS

A. Cleaners, adhesives, sealants, caulking and fasteners furnished by the EPDM system Manufacturer and as listed below. Use low VOC adhesives and cleaners as required by regulations in effect at the time of application.

1. Stripping: 90 mil thick 5 inch and 9 inch wide self adhering flashing, consisting of 45 mils of semi-cured EPDM factory laminated to 45 mils of cured seaming tape.

2. Bonding Adhesive: High strength contact adhesive.

3. Splice Adhesive: High strength synthetic polymer based contact cement formulated specifically to splice EPDM sheets.

4. Lap Sealant: EPDM rubber based gun grade sealant.

5. Water Block Seal: One component low viscosity butyl rubber sealant.

6. Pre-Molded Pipe Flashing: Pressure sensitive prefabricated flashings with pre-applied adhesive.

7. Pourable Sealer: Two component, solvent free polyurethane based sealant.

8. Reinforced Perimeter Fastening Strips: 030 inch thick reinforced cured EPDM.

9. Seam Tape Primer: Synthetic rubber polymer based primer designed to clean and prime seam tape spice areas prior to installing the tape.

10. Seam Splice Tape: Nominal 30 mil thick cured polymer self adhesive tape with release paper carrier, 7 inches wide.

11. Plates and Bars: Galvanized and corrosion resistant specialty products.

12. Fasteners: #14 Fluorocarbon polymer coated heavy duty screws.

B. Primer & Vapor Barrier: (Concrete Substrates)

1. Primer: Thin, cut back asphalt meeting ASTM D41.

2. Vapor Barrier: Fire resistant torch grade SBS modified granular surfaced polyester and glass scrim reinforced cap sheet meeting ASTM D 6163 Type I, Grade G, furnished by the same manufacturer as the EPDM.

C. Gypsum Board: 1/4 inch thick fire resistant gypsum board decking with inorganic glass mat facers and a water resistant core, formulated in 48 x 96 inch square edge boards, UL Class A, meeting ASTM C-1177, manufactured under the trade name Dens-Deck Prime.

D. Insulation:

1. Isocyanurate – Rigid cellular polyisocyanurate boards with fibrous felt/fiberglass mat facers, minimum compressive strength 20 psi, meeting ASTM C1289-01, Type II, Class1, Grade 2, as manufactured by Firestone under the trade name of “ISO 95+ Isocyanurate Insulation”.

a. Tapered insulation sloping 1/8 per foot, minimum starting thickness 2 inches.

b. Crickets sloping 1/4 inch per foot.

2. Tapered edge strips – high density isocyanurate or wood fiberboard strips installed at the drain sumps and cricket edges.

E. Insulation adhesive:

1. Two component low rise polyurethane foam adhesive, installed with a mixing extruding Pace-Cart dispenser, or with a pleural heated foam rig - Firestone I.S.O. Adhesive intended for application at the temperatures that will be encountered.

2. Do not use twin cartridge “caulking gun” adhesive except on very small isolated sections of roof.

PART 3 EXECUTION

3.1 GENERAL

A. Construct the new roofing system in a watertight, workmanlike manner, meeting the guarantee requirements specified herein; in strict accordance with the drawings and in conformance with the Manufacturer's requirements, except as enhanced in this specification.

B. Perform work in areas with roof mounted mechanical equipment, so the work coincides with equipment shutdown periods and does not affect building occupants. Temporarily cover and protect equipment openings, and windows adjoining the work area, with 6 mil fire retardant polyethylene, so dirt, dust and odors do not enter the equipment or building. Remove covers at the end of each workday, and as soon as roof work is complete.

C. Clean the surface on which roofing system components will be applied, of all laitance, dirt, oil, grease or other foreign matter which would in any way affect the quality of the installation.

D. Install roof system components on dry surfaces only. Do not install any items when weather conditions and outside temperatures are not suitable in accordance with the Manufacturer's recommendations.

E. Complete all work in sequence as quickly as possible so that as small an area as practicable is in the process of construction at any one time. Complete the entire area of work begun each day, the same day, and make all exposed edges watertight at the end of each day's work.

F. Do not walk on, or transport material or debris over, new EPDM roofing.

3.2 SUBSTRATE INSPECTION

A. Immediately notify the Architect and Owner's representative if defects in the substrate are discovered.

3.3 VAPOR BARRIER (Concrete Substrates)

A. Install primer and a vapor barrier on the concrete deck: install the primer and allow it to dry.

B. Starting at the low point, torch apply and fully adhere modified bitumen vapor barrier sheets to the primed substrate. Lap sheets at least 4 inches at the ply overlaps and at least 6 inches at the end laps.

C. Carefully install the vapor barrier sheets to achieve only the minimum required bleed out.

D. Extend vapor barrier up vertical surfaces at the roof perimeter, and up and around all penetrations and curbs, and seal the vapor barrier to provide continuity of the building air/vapor envelope.

3.4 INSULATION AND COVER BOARD

A. Install tapered insulation neatly cut at all miters and transitions. Do not lace corner boards.

B. Install insulation with joints offset between rows and layers a minimum of 12 inches. Cut insulation to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.

C. At Metal Deck Substrates: Fasten all layers of insulation only to the top flute of steel decks, with screws and discs which penetrate through the deck a minimum of 3/4 inch and a maximum of 1-1/2 inches.

1. Install 16 fasteners per 4 by 8 foot insulation board in the field of the roof.

2. Install 28 fasteners per 4 by 8 foot insulation board in 8 foot wide perimeter zones.

3. Install 32 fasteners per 4 by 8 foot insulation board in 8 foot square corner zones.

4. Inspect the underside of the deck before installing the screws, and position the screws to avoid penetrating pipes and conduits that may be under the deck.

D. At Concrete Substrates:: Install insulation and gypsum cover board in low rise polyurethane foam adhesive applied in accordance with the Manufacturer’s recommendations and to achieve the specified minimum uplift resistance.

1. Install 1/2 inch diameter adhesive beads spaced 12 inches on center in the field of the roof.

2. Install 1/2 inch diameter adhesive beads spaced 6 inches on center in 8 foot wide perimeter zones.

3. Install 1/2 inch diameter adhesive beads spaced 4 inches on center in 8 foot square corner zones.

E. Install gypsum cover board in low rise foam adhesive, as specified above, over the insulation with joints offset between rows and layers a minimum of 12 inches. Cut gypsum cover board to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.

F. Place 5 gallon pails half full of gravel or concrete on the insulation and gypsum cover board to hold it firmly in position while the low rise foam adhesive sets. Position the pails no more than 24 inches apart in all directions; at least place one pail at each corner and one pail in the center of each 4 foot square piece of gypsum board.

3.5 EPDM

A. Position the EPDM roofing over the substrate without stretching it, and allow it to relax approximately one hour – then adhere it to the substrate and forming the seams.

B. Position adjoining sheets in the same manner lapping the edges about 8 inches.

C. Adhere the EPDM to the substrate in a full coat of bonding adhesive.

1. Open each can of adhesive and stir it with an electric paddle mixer for at least 5 minutes before applying the adhesive. Re-stir adhesive that isn't used within two hours of initial mixing.

2. Do not punch holes in cans of adhesive and use them in a "Better Spreader" without first opening the cans to mix them.

3. Replace used roller covers each day; discard covers after each days use.

4. Allow bonding adhesive to dry to the touch before joining the EPDM to the substrate.

5. Roll the EPDM onto the dried bonding adhesive and immediately rub it vigorously with a soft bristle broom to ensure complete adhesion.

6. Roofing (including the insulation and cover board) installed using adhesive that wasn't first stirred or over improperly applied adhesive, and roofing installed with blisters, ridges, mole runs and similar deficiencies shall be removed and replaced at the Contractor's expense.

3.6 SPLICING

A. Form all EPDM roof splices with 7 inch wide seam tape.

1. Fold the top sheet back about 8 inches. Clean both mating surfaces using clean rags with splice wash.

2. Scrub a smooth coat of QuickPrime to both mating surfaces, with long strokes obtaining complete coverage, using approximately 1 gallon per 225 square. Do not allow the QuickPrime to glop, streak or puddle. Allow it to dry to the touch before installing the seam tape.

3. Install the seam tape on the bottom sheet of EPDM roofing, using guide marks to position it so 1/8 inch minimum and 1/2 inch maximum will be exposed out of the seam when the seam is complete.

4. Roll and allow the top sheet to fall freely into place without stretching or wrinkling it.

5. Pull the splice tape release paper from within the seam area and neatly mate the seam using hand pressure to rub the membrane together.

6. Immediately roll the splice with a 2 inch wide roller, using positive pressure, toward the outer edge of splice.

B. Install uncured EPDM surface patches with rounded corners, over all T-Seam intersections.

C. Install 5 inch uncured EPDM stripping over any seam where the tape is exposed less than 1/8 inch or more than 1/2 inch.

3.7 PERIMETER FASTENING

A. Secure the EPDM at the perimeter of each roof level, and at eaves, penetrations, expansion joints and slope changes greater than 1 inch in 12 inches. Secure discs through the membrane or adhere it to continuous reinforced EPDM fastening strips. Fasten the discs and EPDM fastening strips 12 inches on center.

3.8 FLASHING

A. Utilized cured EPDM for all flashings; utilize self-curing EPDM at corners and angle changes only where required by the Manufacturer.

1. Form flashing splices, and the splice between the flashing and main roof sheet with 7 inch seam tape.

2. Adhere the flashing to vertical surfaces with bonding adhesive.

3. Fasten the top edge of all flashings, positioning the fasteners 12 inches on center, to be covered by the cap flashing.

B. Install premolded pipe flashings wherever possible. Where premolded pipe flashings cannot be installed, use field wrapped flashings. Install pitch pockets as a last resort.

C. Remove existing pipe flashings and Kennedy type couplings and extend the vent pipes to finish a minimum of 18 inches and a maximum of 22 inches above the roof surface.

3.9 MISCELLANEOUS

A. Provide any miscellaneous roofing, flashing, caulking, and metal work needed to leave the work complete and entirely watertight, neatly and carefully executed in a thorough and workmanlike manner.

B. Perform work on mechanical and electrical items using mechanics skilled and licensed in these trades. Provide new material, couplings, transition pieces, blocking, fasteners and the like needed to complete the work.

3.10 CLEANING, PROTECTION AND WATERTIGHTNESS

A. Conduct an inspection of the interior and exterior of the building and grounds, and submit a written report with photos to document any pre-existing leakage or damage, prior to performing any work.

B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leakage or damage which was not documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.

C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.

D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather which may occur unexpectedly. Make all work areas watertight at the end of each day's work.

E. Frequently clean up all refuse, rubbish, scrap materials and debris so the work site presents a neat, orderly and workmanlike appearance.

F. Carefully clean the roof to remove all residual debris when work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

3.11 ROOF INSPECTIONS BY MANUFACTURER

A. Arrange for the roofing Manufacturer, or his authorized representative, to make a minimum of four inspections in accordance with the following schedule and submit a written report of each inspection to the Architect within one week following each inspection:

1. First inspection during the first two days of new roof installation.

2. Second inspection when roofing is approximately one third complete.

3. Third inspection when roofing is approximately two thirds complete.

4. Final inspection at the completion of all work.

B. Provide 48 hours advance written notice to the Architect, so he may have a representative attend the inspections.

C. Payment requisitions will not be reviewed nor approved until the inspection reports are received.

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Sealants for joints within sheet metal fabrications.

1.3 RELATED REQUIREMENTS

A. Section 06 1010 - Roof Related Rough Carpentry.

B. Section 07 5010 - Modifications to Existing Roofing.

C. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.4 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

F. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

G. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007, with Editorial Revision (2012).

J. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

B. Review methods and procedures related to sheet metal work, including but not limited to the following:

1. How the application of sheet metal items will be coordinated with the installation of wood blocking, roofing & flashing materials, ice and water shield, underlayment, and other similar items to provide a watertight installation.

2. Commercial practice and the Manufacturer's instructions for handling and installing his materials.

3. The condition of sheet metal substrates, curbs, penetrations and other preparatory work, needed and/or performed by other trades.

4. The schedule for mock-up construction and approval.

5. The construction schedule: availability of sheet metal materials, personnel, equipment and facilities needed to make progress and avoid delays.

6. Weather and forecaster weather conditions, and procedures for coping with unfavorable weather conditions.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Technical literature for each type of sheet metal, sealant and fastener.

C. Manufacturer's technical literature and shop drawings for preformed sheet metal items, which show how to install the items, form and seal joints

D. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

E. Samples: Submit four samples, 6 x 6 inch in size illustrating material, finish, and fabrication details of each typical shape.

F. Samples of each type of fastener.

G. Material Safety Data Sheets

1.7 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five (5) years of documented experience.

1. The Installer shall provide a list of at least five completed projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner.

2. The Installer shall directly employ the personnel performing the work of this section.

3. Installer's Field Supervision: Maintain a full time supervisor-foreman on the roof, who has a minimum of five (5) years experience in roof related sheet metal work, and who speaks fluent English, when sheet metal work is in progress.

4. Attend the Pre-roofing conference and review methods and procedures related to sheet metal work, including but not limited to the following:

   a. How the application of sheet metal items will be coordinated with the installation of masonry, wood blocking, roofing & flashing materials, insulation, and other similar items to provide a watertight installation.

   b. Commercial practice and the Manufacturer's instructions for handling and installing his materials.

   c. The condition of sheet metal substrates, curbs, penetrations and other preparatory work, needed and/or performed by other trades.

   d. The schedule for mock-up construction and approval.

   e. The construction schedule, and the availability of sheet metal materials, personnel, equipment and facilities needed to make progress and avoid delays.

   f. Weather and forecast weather conditions, and procedures for coping with unfavorable weather conditions.

1.8 JOB MOCK UPS

A. After the submittals are approved, prepare in actual job locations, mock-ups of cap flashings, hook strips, drip edges, fascia, copings, and all other items of sheet metal and related work, for the inspection and approval of the Architect.

B. Construct each mock-up of two full lengths of metal, fastened, connected and stripped-in to the related roofing system, to show the following:

   1. Type, gauge, color, cross-sectional dimensions and shape, and joint and mitering techniques.

   2. Related masonry work, wood blocking, and the attachment techniques and fasteners for all wood and metal components.

   3. Other sheet metal related materials and their installation techniques to fully define the detailing of each mock-up

C. The purpose of each mock-up is to establish the minimum standard of materials and workmanship, and to assure that completed work based on the mock-ups will be fully functional and will serve the purpose for it has been designed.

D. Approved mock-ups may be left in place and incorporated into the permanent installation. Rejected mock-ups shall be removed and replaced until approved.

E. Do not purchase or fabricate sheet metal items until mock-up erection, inspection and approval is completed and approval is documented in writing

1.9 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that could cause discoloration or staining.

1.10 GUARANTEE

A. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion.

1. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, and undue expansion.

B. The Guarantee shall include the removal and replacement of items or materials installed with sheet metal flashings and accessories as part of the original work, if removal is needed to effect guaranteed repairs

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Zinc-Tin coated copper: copper sheet, coated on both sides, with a smooth uniform coating of zinc and tin, nominal weight 16 ounces per square foot, cold rolled temper, available as FreedomGray Copper by Revere.

B. Anodized Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 20 gauge, 0.032 inch thick; clear anodized finish.

C. Pre-Finished Aluminum:

1. Superior-Performance Organic Finish: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturer's written instructions.

a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat thermocured system consisting of specially formulated inhibitive primer fluoropolymer color coat, and clear fluoropolymer top coat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

b. Color: As selected by Owner's Representative from manufacturer's standard colors.

c. Product: "AnchorGard SP" Firestone Building Products Company

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

1. Accurately reproduce the details and design shown, and form the profiles, bends and intersections, sharp, true and even. Fabricate sheet metal in the shop whenever possible, and form joints, laps, splices and connections to shed water and condensation in the direction of flow.

2. Provide any miscellaneous flashing and sheet metal work not shown on the drawings but otherwise needed to leave the project complete and entirely watertight, neatly and carefully executed in a thorough and workmanlike manner

B. Fabricate and install copper work in accordance with the current edition of "Copper and Common Sense" published by the Revere Copper and Brass Company, unless otherwise indicated

C. Fabricate cleats of same material as sheet, minimum 3 inches wide, interlocking with sheet.

D. Form pieces in longest possible lengths.

E. Hem exposed edges on underside 1/2 inch; miter and seam corners.

F. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

G. Tin edges of copper sheet to be soldered; solder shop formed metal joints, and after soldering, remove flux, wipe and wash solder joints clean; provide weathertight joints.

H. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

J. Through Wall Flashing: Fabricate new through wall flashings to extend the entire width of the masonry wall, turn down 3/4 inch on the exterior and 4 inches with a 1/2 inch hem on the interior.

1. Set through wall flashings on a skim coat of mortar used to level the wall.

2. Form all seams, except sealant filled expansion seams, in the through wall flashing to overlap 2 inches. Secure the seams with rivets spaced 1 inch apart and sweat solder the joint.

3. Form 2 inch wide flat locked sealant filled expansion seams 32 feet on center.

4. Install stainless steel dowels through the new through wall flashings, positioned so that each piece of coping will be secured with a minimum of two dowels.

5. Pre-tin the dowels, and solder the dowels to the through wall flashing to form a watertight seal, before the copings are re-installed

2.3 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Concealed Sealants: Non-curing butyl sealant.

E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

F. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

G. Solder:

1. Lead free / or pure tin solder for zinc-tin coated copper, Number 497 by Johnson Manufacturing.

H. Flux:

1. Tin-bearing flux such as “Flux-N-Solder E127 with pure tin” by Johnson Manufacturing

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive work of this section and report to the Owner's Representative any defects affecting installation. Commencement of work will be construed as complete acceptance of surfaces.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.3 INSTALLATION

A. Fabricate and install copper work in accordance with "Copper and Common Sense" as published by the Revere Copper and Brass Company, unless otherwise indicated.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Form all joints, except loose locked sealant filled expansion joints, 3/4 inch wide flat locked and soldered, or, overlapped 2 inches riveted 1 inch on-center and soldered. Use solder only to fill and seal the joint, not for mechanical strength. Form soldered joints continuous, strong and free from defects, with well heated soldering irons. Do not use open flame torches for soldering.

1. Clean soldered joints daily, immediately upon the completion of soldering, by washing with soap and water applied with a soft bristle brush, then rinsing with clear water.

D. Form all seams double locked, to finish 1 inch high. Install cleats in all seams 12 inches on center.

E. Securely fasten and anchor all work, and make provisions for thermal expansion. Submit details of expansion joints for approval. Install fasteners through one edge of metal only.

F. Use stainless steel pin Zamac type nail-in fasteners where fasteners will be exposed

G. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.5 CLEANING

A. Clean all metal of any stains or blemishes; touch up and clean prefinished material after roofing is complete. Leave all surfaces clean and satisfactory to the Owner.

3.6 PROTECTION AND WATERTIGHTNESS

A. Provide the equipment, materials and labor necessary to adequately protect the contract area, the building and its contents and occupants, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.

B. Do not perform work during inclement weather. Provide temporary covers, and make work areas and the building watertight at the end of each day's work.

C. Clean up frequently all refuse, rubbish, scrap materials and debris so that at all times the work site shall present a neat, orderly and workmanlike appearance

SECTION 07 7200
ROOF ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Rooftop stairs.

B. Pipe portals.

C. Walkway pads

1.3 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications for roof equipment supports.

B. Section 06 1010 - Roof Related Rough Carpentry

C. Section 07 5010 - Modifications to Existing Roofing

D. Section 07 6200 - Sheet Metal Flashings and Specialties.

E. Mechanical Division 23 for equipment.

F. Electrical Divisions 26 for associated Electrical work.

1.4 CODE REQUIREMENTS

A. Refer to 01 4100 - Regulatory Requirements.

1.5 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Submit the following items in advance to obtain approval prior to performing any work.

C. Product Data: Manufacturer's on each product to be used all technical data sheets required for this project .Incomplete submittals will not be reviewed.

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

4. Maintenance requirements.

D. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1. Coordinate with other prime contractor (s) for roof accessories provided by them and installed by the General Contractor.

E. Samples: Submit samples when requested.

F. Samples of the Contractor’s and Manufacturer’s guarantee/warranty forms.

G. Warranty Documentation:

1. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

2. Submit certification from roofing manufacture that existing warranty remains in effect,

1.7 QUALITY ASSURANCE

A. Standards: Comply with SMACNA "Architectural Sheet Metal Manual" fabrication details and "NRCA Roofing and Waterproofing Manual" installation details unless otherwise indicated.

B. Manufacturer Qualifications: Provide each primary product, produced by a single Manufacturer, which has produced that type product successfully for not less than five (5) years which has manufactured the same product in the United States of America for not less than 5 continuous years.

C. Installer Qualifications: A firm with not less than five (5) years of successful experience installing specialties similar to those required for this project employing personnel skilled in the work specified.

1. The Installer shall provide a reference list of at least three completed projects of comparable size and similar design, within a fifty mile radius of this project.

2. Provide name address, telephone number of Owner, Architect, and Construction Manager

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver material to the site in the Manufacturer's original and unopened packaging, with intact and legible labels which identify the products and Manufacturers

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store products under cover and elevated above grade.

D. Do not overload the structure when storing materials on the roof.

1.9 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year Contractor's warranty for that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Substaintial Completion..

1. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, undue expansion, peeling paint.

2. Guarantee coverage shall have no dollar limit.

3. Contractor’s Guarantee covers “all work performed” when a single contractor/installer is awarded work specified in multiple Sections.

C. The Contractor’s Surety Company may add a rider to the Performance Bond which clarifies that Performance Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor’s Guarantee

D. The Guarantee shall be issued no more than 30 days after approval of the punch list work.

E. The Guarantee shall include the removal and replacement of items or materials installed with the roof specialties as part of the original work, if removal is needed to effect guaranteed repairs.

PART 2 PRODUCTS

2.1 ROOF CURBS

A. Provided by HVAC Contractor and installed by General Contractor. Refer to HVAC drawings.

2.2 ROOFTOP SUPPORTS / ASSEMBLIES

A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly. Provided and installed by HVAC contractor. General Construction Contractor shall provide roof pads.

2.3 ROOFTOP

A. Performance Requirements:

1. Comply with ADA Standards.

2. Uniform Load Capacity: 50 psf.

3. Concentrated Load Capacity: 300 psf.

4. Handrail and Guard Capacity: Support the following loads without exceeding the allowable working stress of the material:

a. Single Point Load: 200 lb.

b. Distributed Load: 50 pfl.

5. See drawing A626 Detail 17.

B. Risers: Open.

C. Stair Finish: Manufacturer's standard mill finish.

2.4 FACTORY FABRICATED PIPE CURB PORTALS

A. Pipe Portals: Provided byHVAC Contractor and installed by General Co0Ontractor. Refer to Mechanical drawings.

1. Provide number of pipes indicate on drawings.

2. Manufacturer: ALTA Products.

a. Model AL-1610 with ALTC-18 curb.

b. .080 aluminum curb, body and lid

c. Thermal- break body and curb

d. Sigrist exit seals, ABS, Schedule 80

e. Housing shall be UV protected powder coated

f. Stainless steel fasteners

3. Attachment and installation of the pipe portal shall be done in accordance with manufacturer's instructions and the roofing membrane manufacturer's recommendations.

2.5 ROOF WALKWAY PADS

A. 30 inches by 30 inches hard rubber walkway pads, color; black, as manufactured by Firestone or equal.

1. Provide under all pedestal supports and concrete pads and where shown on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Fuller and D'Angelo, P.C. of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

B. Coordinate all work interfacing with mechanical and electrical contracts with respective contractors.

C. Roof Walkway Pads

1. Install hard rubber walkway pad for walkways to provide a path 2-1/2 feet wide, where shown on the Drawings, adhered to the membrane surface with **5 strips of peel and stick SeamTape**, and at all roof access points, i.e., doors, ladders and hatches, and under all concrete pavers used for conduit supports. **Manufacturers 3 strip tape shall not be installed.**

3.4 MISCELLANEOUS

A. Provide and install any sealants needed, where shown or required.

B. Provide new material, couplings, transition pieces, blocking, fasteners and the similar accessories needed to complete the work.

C. Adjust safety railing gate to provide positive closure and latching in conformance to OSHA and CPSC requirements.

3.5 CLEANING

A. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather - which may occur unexpectedly. Make all work areas watertight at the end of each day's work

B. Clean installed work to like-new condition.

3.6 PROTECTION

A. Protect existing and new roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not.

B. Speed strips & plugs.

C. Flexible sealant.

D. Joint spray.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.4 REFERENCE STANDARDS

A. ASTM C1241 - Average volume shrinkage: 51.1%

B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2018c.

C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

D. ASTM E 90-99 - Sound Transmission Classification; 59 per tested construction.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015.

G. FM 4991 - Approval Standard for Firestop Contractors; 2013.

H. FM (AG) - FM Approval Guide; current edition.

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

K. UL (FRD) - Fire Resistance Directory; Current Edition.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.6 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD) or FM (AG) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:

1.7 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Install one firestopping assembly representative of each fire rating design required on project.

1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.

C. If accepted, mock-up will represent minimum standard for this work.

D. If accepted, mock-up may remain as part of this work. Remove and replace mock-ups not accepted.

1.8 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Firestopping Manufacturers:

1. Hilti Firestop Systems Hilti, Inc. (U.S.) 1-800-879-8000 www.us.hilti.com • en español 1-800-879-5000 • P.O. Box 21148, Tulsa.

2.2 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.3 SYSTEMS

A. Concrete and Concrete Masonry Walls and Floors:

B. Gypsum Board Walls:

1. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):

   a. 1 Hour Construction: UL System WW-D-0067; **Hilti CP 606** Flexible Firestop Sealant.

2. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Parallel to Ribs:

   a. 1 Hour Construction: UL System HW-D-0049; Hilti **CFS-SP WB** Firestop Joint Spray and CP 672.

3. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Cut to Fit Ribs:

   a. 1 Hour Construction: UL System HW-D-0045; Hilti **CP 606** Flexible Firestop Sealant.

4. Head-of-Wall Joints at Concrete Over Metal Deck, Wall Perpendicular to Ribs, Not Cut to Fit:

   a. 1 Hour Construction: UL System HW-D-0042; Hilti **CFS-SP WB** Firestop Joint Spray and CP 672.

2.4 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

A. Penetrations Through Floors or Walls By:

1. Multiple Penetrations in Large Openings:

   a. 1 & 2 Hour Construction: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2. Uninsulated Metallic Pipe, Conduit, and Tubing:

   a. 1 & 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.

3. Electrical Cables Not In Conduit:

   a. 1 & 2 Hour Construction: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.

4. Insulated Pipes:

   a. 1 & 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX intumescent Firestop Sealant.

5. HVAC Ducts, Uninsulated:

   a. 1 & 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.

B. Penetrations Through Floors By:

1. Multiple Penetrations in Large Openings:

   a. 1 & 2 Hour Construction: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.

2. Uninsulated Metallic Pipe, Conduit, and Tubing:

   a. 1 & 2 Hour Construction: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.

3. Insulated Pipes:

   a. 2 Hour Construction: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.

C. Penetrations Through Walls By:

1. Uninsulated Metallic Pipe, Conduit, and Tubing:

   a. 2 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.

   b. 1 Hour Construction: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2. Electrical Cables Not In Conduit:

   a. 2 Hour Construction: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.

3. Insulated Pipes:

   a. 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

   b. 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

4. HVAC Ducts, Uninsulated:

   a. 1 & 2 Hour Construction: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.

5. HVAC Ducts, Insulated:

    a. 1 & 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.5 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Penetrations By:

1. Multiple Penetrations in Large Openings:

    a. 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2. Uninsulated Metallic Pipe, Conduit, and Tubing:

    a. 1 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.

3. Electrical Cables Not In Conduit:

    a. 1 Hour Construction: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for Existing Cables.

4. Insulated Pipes:

    a. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.

5. HVAC Ducts, Insulated:

    a. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.6 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:

1. Manufacturers:

    a. 3M Fire Protection Products; Product CP-25WB: www.3m.com/firestop.

    b. Substitutions: See Section 01 2500 Substitution Procedures.

C. Fiber Firestopping: Mineral fiber insulation used in conjunction with elastomeric surface sealer forming airtight bond to opening; conforming to the following:

1. Density: 4 lb/cu ft.

2. Manufacturers:

   a. Thermafiber, Inc: www.thermafiber.com.

3. Substitutions: See Section 01 2500 Substitution Procedures.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.3 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.4 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Acoustical sealant.

D. Joint backings and accessories.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 07 8400 - Firestopping: Firestopping sealants.

C. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

E. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

F. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.4 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012 (Reapproved 2017).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

E. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.

3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

4. Substrates the product should not be used on.

5. Substrates for which use of primer is required.

6. Sample product warranty.

7. Certification by manufacturer indicating that product complies with specification requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

F. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

G. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

H. Executed warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.

1. Identification of testing agency.

2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.

    a. Test date.

    b. Copy of test method documents.

    c. Age of sealant upon date of testing.

    d. Test results, modeled after the sample form in the test method document.

    e. Indicate use of photographic record of test.

E. Field Quality Control Plan:

1. Visual inspection of entire length of sealant joints.

F. Field Adhesion Test Procedures:

1. Allow sealants to fully cure as recommended by manufacturer before testing.

2. Have a copy of the test method document available during tests.

3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.

4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.

5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Edgemont Union Free School District.

6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Fuller and D'Angelo, P.C. .

G. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.

1. Sample: At least 18 inches long.

2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.

3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Edgemont Union Free School District's name and register with manufacturer.

1.8 MOCK-UP

A. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.

1. Sika Corporation[<>]: www.usa-sika.com.

2. Bostik Inc: www.bostik-us.com.

3. Dow Corning Corporation: www.dowcorning.com/construction.

4. Pecora Corporation: www.pecora.com.

5. W.R. Meadows, Inc: www.wrmeadows.com/sle.

6. Substitutions: Section 01 2500 Substitution Procedures.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.

1. Sika Corporation[<>]: www.usa-sika.com.

2. Pecora Corporation: www.pecora.com.

3. W.R. Meadows, Inc: www.wrmeadows.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustic Sealants

1. Pecora

2.2 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:

    a. Wall expansion and control joints.

    b. Joints between door, window, and other frames and adjacent construction.

    c. Joints between different exposed materials.

    d. Openings below ledge angles in masonry.

    e. Other joints indicated below.

    f. Sidewalk expansion joints

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.

    a. Joints between door, window, and other frames and adjacent construction.

B. Exterior Vertical Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

C. Interior Vertical Joints: Use non-sag polyurethane sealant, unless otherwise indicated.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Exterior and Interior Horizontal Joints: Single component, self-leveling, premium-grade polyurethane sealant

2.3 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 6116.

2.4 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: [CHOICE TEXT], minimum.

2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.

3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.

5. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard and premium range.

6. Cure Type: Single-component, neutral moisture curing.

7. Service Temperature Range: Minus 20 to 180 degrees F.

8. Manufacturers:

   a. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com.

   b. Sika Corporation; Sikasil WS-295: www.usa-sika.com.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

1. Color: White.

2. Applications: Use for:

   a. All perimeter joints of toilet fixtures, cabinets, casework, countertops and similar locations.

3. Manufacturers:

   a. Sika Corporation; Sikasil GP: www.usa-sika.com.

   b. 786 Mildew Resistant; Dow Corning.

   c. Pecora Corporation; Pecora 898 NST (Non-Staining Technology):: www.pecora.com.

   d. Sanitary 1700; GE Silicones..

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 25 percent, minimum.

2. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.

3. Service Temperature Range: Minus 40 to 180 degrees F.

4. Manufacturers:

   a. Sika Corporation; Sikasil GP: www.usa-sika.com.

   b. Pecora Corporation; Dynatrol II;: www.pecora.com.

5. Applications: Use for:

   a. All exterior and interior vertical joints.

6. Substitutions: 01 2500 - Substitution Procedures.

D. Type Acoustical Sealant: -Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-hardening, non-sagging; not intended for exterior use.

1. Color: To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.

2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

3. Manufacturers:

   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.

4. Applications: Use for:

   a. Use for all interior joints of where acoustical sealant indicated.

5. Substitutions: 01 2500 - Substitution Procedures

2.5 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.

   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C - Closed Cell Polyethylene.

   3. Open Cell: 40 to 50 percent larger in diameter than joint width. (Not to be used in flat or horizontal joints)

   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width. (Use for flat and horizontal joints)

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.

   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.

   2. Notify Fuller and D'Angelo, P.C. of date and time that tests will be performed, at least seven days in advance.

   3. Record each test on Preinstallation Adhesion Test Log as indicated.

4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Fuller and D'Angelo, P.C. .

5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Self-leveling joints: Recess joint depth as recommended by the sealant manufacturer.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

C. Hollow metal borrowed lites glazing frames.

D. Patching existing metal frames.

E. Verification of existing rated doors and or frames.

F. Foam door seal.

1.3 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing

C. Section 09 2116 - Gypsum Board Assemblies.

D. Section 09 9123 - Interior Painting: Field painting.

1.4 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. HMMA: Hollow Metal Manufacturers Association.

C. NFPA: National Fire Protection Association.

D. SDI: Steel Door Institute.

E. UL: Underwriters Laboratories.

1.5 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

H. ASTM C476 - Standard Specification for Grout for Masonry; 2018.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

O. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

S. UL (BMD) - Building Materials Directory; current edition.

T. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations and frame profiles

D. Samples: Submit two samples of metal, 2 by 2 inches in size, showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten (10) years experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five (5) years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

D. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as scheduled.

E. **Existing Frames: All existing frames in rated openings, which will receive fired doors and without UL labels, shall be certified as conforming to rating indicated on drawings**.

1. Testing Agency: provided by Inchcape Testing Services, Warnok Hersey 716-875-9775.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Steelcraft, an Allegion brand 1819 N. Pennsylvania St. Carmel, IN 46032; Toll Free Tel: 877-578-1247; Product GRAINTECH Series: Full flush design door: www.allegion.com/us.

2. Substitutions: See Section 01 25 00 Substitution Procedures.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.

3. Door Top Closures: Flush end closure channel, with top and door faces aligned.

4. Door Edge Profile: Beveled.

5. Typical Door Face Sheets: Flush with wood grain. Refer to Door Schedule for additional information.

6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

    a. Provide 14 gauge channel reinforcing for all door closers.

7. Galvanizing including all doors and frames: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.

2.3 EMBOSSED WOOD GRAIN FINISH DOORS

A. Full Flush Doors:

B. Acceptable Product: Steelcraft GrainTech Series.

1. Performance:

    a. Physical performance: 5 million cycles per ANSI A250.4.

    b. Sound attenuation (gasketed):

        a) Honeycomb core, 35 STC.

    c. Thermal performance (gasketed), ASTM C1363.

        a) Polystyrene core, 0.48 U-factor.

    d. Thermal performance (gasketed), ASTM C236.

        a) Honeycomb core, 0.363 U-factor.

C. Door Thickness: 1-3/4 inches.

D. Gauge: 16 Gauge.

E. Door faces reinforced and sound deadened as follows:

1. Honeycomb Core:

    a. Sanded for maximum adhesion.

    b. Impregnated with phenolic resin.

    c. Laminated to both faces sheets with contact adhesive.

F. Vertical edge seams: Provide doors with continuous vertical mechanical inter-locking joints at lock and hinge edges. Finish edges as follows:

1. Full Height, Epoxy Filled Mechanical Interlock Edges provide structural support and stability the full height of the door edges.

a. Filled Edge Seam: Seam filled with structural adhesive and dressed smooth. Includes tack welds above and below edge cutouts as required for doors over 7'-2" rated over 20 minutes.

G. Bevel hinge and lock door edges 1/8 inch (3 mm) in 2 inches (50 mm). Square edges on hinge and/or lock stiles are not acceptable.

H. Reinforce top and bottom of doors with galvannealed 14 gage (1.7 mm), welded to both panels.

I. Glazing Bead: Formed steel sheet or snap-in Designer trim.

J. Fire Rating: Supply door units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

K. In addition to the requirements listed the following apply where wood grain finished are indicated:

1. Fabricated from steel that has an embossed wood grain pattern extending the full height and width of the door. Provide a wood grain embodiment minimum .005” deep. Applied grain pattern or material is not acceptable.

L. Anchors: Manufacturer's standard framing anchors, specified in manufacturer's printed installation instructions for project conditions.

M. Astragals for pairs of doors: Manufacturer's standard for labeled and non-labeled openings.

N. Door Bottom:

1. Acceptable Product: Steelcraft Fas-Seal Door Bottom.

2. Characteristics: Electrometric, continuous strip, screw-attached to recessed bottom door channel for concealed installation; double-sealing; acceptable for fire-rated doors up to 3 hour rating.

O. Plaster Guards: Same material as door frame, minimum 24 gage (0.5 mm) minimum; provide for all strike boxes.

P. Silencers: Resilient rubber, Inserted type, three per strike jamb for single openings and two per head for paired openings. Stick-on silencers shall not be permitted except on hollow metal framing systems.

1. Provide silencers on all existing frames.

Q. Finish: Complete factory finish.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Repair Frames as indicated on drawings or required, cut and reweld new frame material and finish to match existing surfaces. Prime and paint frames.

D. Interior Door Frames: Full profile/continuously welded type..

1. Fire Rating: Same as door, labeled.

2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.

3. Frame Finish: Factory primed and field finished.

2.5 FINISHES

A. Refer to Section 09 91 23 Interior Painting.

B. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

C. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

1. Color: Maple.

2.6 ACCESSORIES

A. Glazing Trim: As per manufacturer's standard for doors and glass thickness.

B. Glazing: As specified in Section 08 8000, factory installed.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.

1. UL listed products in compliance with requirements of authorities having jurisdiction.

2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.

E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

H. Frame Anchors: Minimum of six wall anchors and two base anchors.

1. T anchors for masonry.

2. Clips angles for metal framing.

I. Frame Repairs:

1. Repair dents, patch rust holes, fill in chips etc.

2. Body Filler With Hardener.

3. Color: Light Gray.

4. Manufacturer: 3M Product "Bondo Body Filler 265".

J. Foam window and door seal.

1. Fill all exterior joint between windows and doors solid in accordance with manufacture's instructions.

2. Cut back to permit application of joint sealant.

3. Insulating-Foam Sealant: Dow "Great Stuff Window & Door.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

B. Patch existing frames as required to remove rust, dents, chips and fill holes.

1. Appy body filler i accordance to manufacturer's instruction.

2. Sand surfaces smooth.

3.3 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated and NAAMM HMMA 840.

B. Coordinate frame anchor placement with wall construction.

C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

D. Install door hardware as specified in Section 08 7100.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

E. Comply with glazing installation requirements of Section 08 8000.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Install perimeter foam seal in accordance with requirements specified in Section 07 9005.

1. Fill all exterior spaces and joint between windows and doors solid with foam in accordance with manufacture's instructions.

2. Cut back to permit application of joint sealant.

H. Touch up damaged factory finishes.

3.4 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.6 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

SECTION 08 1613
FIBERGLASS DOORS AND ALUMINUM FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Fiberglass doors installed in thermal break aluminum framing.

B. Fiberglass doors SL-17 Pebble Grain FRP/ Aluminum Hybrid Door installed in Thermally Broken Aluminum Framing.

C. Glazing.

D. Snap trim.

E. Factory installed Finish Hardware

F. Foam door seal.

G. Accessories.

1.3 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements

B. Section 01 7800 - Closeout Submittals

C. Section 04 2000 - Unit Masonry

D. Section 05 5000 - Metal Fabrications for steel lintels.

E. Section 08 1213 - Hollow Metal Frames.

F. Section 08 7100 - Door Hardware.

1.4 Reference Standards

A. AAMA 1304 - Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems; 2018.

B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

D. ASTM-B117 – Standard Practices for Operating Salt Spray (Fog) Apparatus.

E. ASTM-B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

F. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

G. ASTM-C518 – Standard test Method for Steady-State Thermal Transmission Properties by Means of Heat

H. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

I. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

J. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

K. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2016.

L. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics

M. ASTM-D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics.

N. ASTM D 1623 - Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics

O. ASTM D 2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging

P. ASTM D 2583 - Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor

Q. ASTM-D3029 – Test Methods for Impact Resistance of Flat Rigid Plastic Specimens by Means of a Tup (Falling Weight) (Withdrawn 1995) (Replaced by ASTM-D5420).

R. ASTM-D5116 – Standard Guide for Small-Scale Environmental Chamber Determinations of Organic

S. ASTM D 5420 – Impact Resistance of Flat Rigid Plastic Specimens by Means of a Falling Weight.

T. ASTM D 6670 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products

U. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

V. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

W. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

X. ASTM-E1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

Y. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2017.

Z. ASTM F 476 - Security of Swinging Door Assemblies.

AA. ASTM-F1642-04 – Standard Test Method for Glazing Systems Subject to Air Blast Loading.

BB. NWWDA T.M. 7-90 - Cycle Slam Test Method

CC. NFRC 100 – Procedure for Determining Fenestration Products U-Factors.

DD. NFRC 400 – Procedure for Determining Fenestration Products Air Leakage.

EE. TAS 201 – Impact Test Procedures.

FF. TAS 202 – Criteria for Testing Impact & Non-impact Resistant Building Envelope Components Using Uniform Static Air Pressure.

GG. TAS 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.

C. Shop Drawings: Indicate layout and profiles; include assembly methods.

1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.

2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.

D. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

E. Door Corner Sample: When requested submit corner cross sections, 10 inches by 10 inches in size, illustrating construction, finish, color, and texture.

F. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements listed in Part 2.

G. Installer's Qualification Statement.

H. Maintenance Data: Include instructions for repair of minor scratches and damage.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Edgemont Union Free School District's name and registered with manufacturer; include detailed terms of warranty.

J. Closeout Submittals.

1. Operation and Maintenance Manual.

    a. Submit manufacturer's maintenance and cleaning instructions for doors and frames, including maintenance and operating instructions for hardware.

2. Warranty Documentation.

    a. Submit manufacturer's warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than twenty years of documented experience.

1. Door and frame components from same manufacturer.

2. Evidence of a compliant documented quality management system.

3. The manufacturer shall provide a factory trained technician to visit this project and instruct the installers in the proper installation of the door and frame assemblies.

B. All materials, equipment and operation supplied shall conform to all Code requirements including Accessibility for the Handicapped.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Mark doors with location of installation, door type, color, and weight.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Materials shall be inspected for damage, and the manufacturer shall be advised immediately of any discrepancies. Unsatisfactory materials are not to be used.

C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.

1. Labels clearly identifying opening, door mark, and manufacturer.

2. Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.

3. Store at temperature and humidity conditions recommended by manufacturer.

4. Do not use non-vented plastic or canvas shelters.

5. Immediately remove wet wrappers.

6. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

1.9 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Special Project Warranty:

1. Provide a written warranty signed by Manufacturer, Installer and Contractor, agreeing to replace, at no cost to the Owner, any doors or frames that fail in materials or workmanship, within the time period of acceptance, as indicated below. Failure of materials or workmanship includes excessive deflection, faulty operation of entrances, deterioration of finish, or construction, in excess of normal weathering, and defects in hardware, weather stripping, and other components of the work. In addition the manufacturer further certifies that they have factory installed all hardware and such hardware is also guaranteed not to come loose during the guarantee period.

2. Warranty Time Period: Ten (10) Years from substantial completion.

3. Limited lifetime

a. Covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

b. Failure due to corrosion on FRP components.

4. Finish

a. Painted SL-17, SL-18, and FRP face sheets: 5 years.

b. Painted AF-150 frames, AF-250 frames: 3 years.

5. All warranties shall commence at Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Reinforced Plastic Doors:

1. Special-Lite, Inc; PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531. Phone (269) 423-7068. Fax (800) 423-7610. Web Site www.special-lite.com. E-Mail info@special-lite.com.: www.special-lite.com.

2. Substitutions: Section 01 2500 Substitution Procedures..

2.2 DOOR AND FRAME ASSEMBLIES

A. Model.

1. SL-17 Smooth Finish door installed in Thermally Broken Aluminum Framing

2. SL-18 Colonial wood grain hybrid FRP door in stalled in thermally broken aluminum frame.

2.3 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.

1. Thickness: 1-3/4 inch, nominal.

a. Core: Expanded polystyrene foam (EPS).

b. Laid in foam cores are not acceptable.

c. SL-17 and SL-18: Foam Plastic Insulated Doors: IBC 2603.4.

d. Foam plastic shall be separated from the interior of a building by an approved thermal barrier.

e. Approved thermal barrier must meet the acceptance criteria of the Temperature Transmission Fire Test and Integrity Fire Test as stated in NFPA 275.

f. Comply with IBC/NYSBC 2603.4.1.7. Foam plastic insulation, having a flame spread index less than 75 and a smoke developed index of not more than 450 shall be permitted as a door core when a thermal barrier of metal, minimum 0.032” aluminum or 0.016” steel is provided between the foam core and FRP face sheet.

g. Standard door assembly can be tested to show it meets these requirements without the use of thermal barrier. Testing shall be in compliance with IBC/NYSBC 2603.9. If no independent testing conducted all doors with foam plastic core must have a thermal barrier.

2. Face Sheet.

a. Exterior

a) 0.120” thick, pebble texture, through color with SpecLite 3® integral surfaseal film FRP sheet.

b. Interior

a) 0.120” thick, pebble texture, through color with SpecLite 3® integral surfaseal film FRP sheet.

b) Class C standard optional Class A available consult manufacturer.

c. Attachment of face sheet.

a) Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.

b) Use of glue to bond face sheet to core or extrusions is not acceptable

3. Door Panel Configuration: As indicated on drawings.

4. Reinforcements:

   a. Aluminum extrusions made from 6061 or 6063 aluminum alloys

   b. Sheet and plate to conform to ASTM-B209.

   c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.

   d. Bars and tubes to meet ASTM-B221.

5. Cutouts.

   a. Manufacture doors with cutouts for required vision lites, louvers, and panels.

6. Fasteners.

   a. All exposed fasteners will have a finish to match material being fastened.

   b. 410 stainless steel or other non-corrosive metal.

   c. Must be compatible with items being fastened.

7. Sustainability Characteristics.

8. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.

9. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.

   a. Pre-machine doors in accordance with templates from specified hardware manufacturers.

   b. Surface mounted closures will be reinforced for but not prepped or installed at factory.

   c. Factory install door hardware.

2.4 FRAMING

A. Thermally Broken Aluminum Framing Model: SL-600TB.

1. Aluminum Members.

   a. Aluminum extrusions made 6061 or 6063 aluminum alloys.

2. Perimeter Frame Members.

   a. Storefront frame with thermally broken pocket filler.

   b. Factory fabricated.

c. Open-back framing is not acceptable

3. Thermal Strut.

a. Fiber reinforced plastic, no other materials will be accepted.

4. Applied Door Stops.

5. 5/8" x 1-1/4" or 5/8" x 1-3/4", 0.125" wall thickness, with screws and weather-stripping.

6. Provide solid ½" aluminum bar behind door stop for closer shoe attachment.

7. Pressure gasketing for weathering seal.

8. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.

9. Minimum ½" aluminum bar reinforcement under doorstop for required hardware attachments, aluminum to meet ASTM-B221

10. Caulking.

a. Caulk joints before assembling frame members.

11. Frame Member to Member Connections.

a. Secure joints with fasteners.

b. Provide hairline butt joint appearance.

c. Shear block construction only, no screw spline allowed.

12. Hardware

a. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.

b. Surface mounted closures will be reinforced for but not prepped or installed at factory.

c. Factory install door hardware

13. Anchors:

a. Anchors appropriate for wall conditions to anchor framing to wall materials.

b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.

c. Secure head and sill members of transom, side lites, and similar conditions.

B. Capping.

1. Model: SL-70.

2. Material: Aluminum extrusions made 6061 or 6063 aluminum alloys.

3. Size as indicated on drawings.

2.5 PERFORMANCE REQUIREMENTS

A. SL-17 Smooth Finish door installed in Thermally Broken Aluminum Framing

B. Face Sheet.

1. Standard Interior and Exterior Class C 0.120” thick, pebble texture, through color with SpecLite 3® integral surfaseal film FRP sheet.

a. Flexural Strength, ASTM-D790: 21 x 103 psi.

b. Flexural Modulus, ASTM-D790: 0.7 x 106 psi.

c. Tensile Strength, ASTM-D638: 13 x 103 psi.

d. Tensile Modulus, ASTM-D638: 1.2 x 106 psi.

e. Barcol Hardness, ASTM-D2583: 55.

f. Izod Impact, ASTM-D256: 14.0 ft-lb/in.

g. Gardner Impact Strength, ASTM-D5420: 120 in-lb.

h. Water Absorption, ASTM-D570: 0.20%/24hrs at 77°F.

i. Surface Burning, ASTM-E84: Flame Spread ? 200, Smoke Developed ? 450.

j. Taber Abrasion Resistance, Taber Test: 0.007% Max Wt. Loss, cs-17 wheels, 1000g. Wt., 25 cycles.

k. Chemical Resistance.

a) Excellent Rating.

(a) Acetic Acid, Concentrated.

(b) Acetic Acid, 5%.

(c) Bleach Solution.

(d) Detergent Solution.

(e) Distilled Water.

(f) Ethyl Acetate.

(g) Formaldehyde.

(h) Heptane.

(i) Hydrochloric Acid, 10%.

(j) Hydrogen Peroxide, 3%.

(k) Isooctane.

(l) Lactic Acid, 10%.

l. USDA/FSIS Requirements.

a) FRP face sheet with SpecLite 3® integral surfaseal is a finished outer surface material that is rigid; durable; non-toxic; non-corrosive; moisture resistant; a light, solid color such as white; easily inspected; smooth or an easily cleaned texture.

b) FRP face sheet with SpecLite 3® integral surfaseal does not contain any known carcinogen, mutagen, or teratogen classified as hazardous substances; heavy metals or toxic substances; antimicrobials; pesticides or substances with pesticidal characteristics.

2. Door Core.

a. Density, ASTM-D1622: ≤ 5.0 pcf.

b. Compressive Properties, ASTM-D1621: Compressive Strength ≥ 60 psi, Compressive Modulus ≥ 1948 psi.

c. Thermal Conductivity, ASTM-C518, Thermal Resistance ≤ 0.10 m2K/W.

3. Door Panel.

a. Thermal Transmittance, AAMA 1503-98: U-Factor = 0.29 Btu/hr/ft²/°F, CRFp = 55.

b. Indoor Air Quality, ASTM-D5116, ASTM-D6607: GreenGuard, GreenGuard Gold.

4. Door and Thermally Broken Aluminum Frame Assembly.

a. Thermal Transmittance, NFRC 100.

a) Opaque Swinging Door (< than 50% glass)

(a) U-Factor = 0.31 Btu/hr/ft² °F.

b) Commercially Glazed Swinging Entrance Door (> than 50% glass)

(a) U-Factor = 0.64 Btu/hr/ft²/°F.

b. Air Leakage, NFRC 400, ASTM-E283.

a) Opaque Swinging Door (< than 50% glass)

(a) 0.01 cfm/sqft @ 1.57 psf.

(b) 0.01 cfm/sqft @ 6.24 psf.

b) Commercially Glazed Swinging Entrance Door (> than 50% glass)

(a) 0.38 cfm/sqft @ 1.57 psf.

(b) 0.73 cfm/sqft @ 6.24 psf.

c. Sound Transmission, ASTM-E90: STC = 30, OITC = 29.

5. Door and Hollow Metal Steel Frame.

a. Cycle Slam, NWWDA T.M. 7-90.

a) 5,000,000 cycles.

(a) No Operational Damage.

(b) No Hinge Separation.

2.6 FINISHES

A. Doors:

1. Paint:

a. Fluoropolymer Two-Coat System: KYNAR

a) Topcoat: 70% KYNAR or HYLAR® 5000 meets or exceeds all AAMA 2605 specifications, 2.5 to 4.0 wet mils,1.00 to 1.20 dry mils.

b) Color: As selected by Architect from manufacturer's standard colors and all metallic colors.

2. Face Sheet: SL-18 face sheets authentic oak species wood grain replication FRP.

a. Use for all SL- 18

b. Color: As selected from full range of manufacture's colors.

B. FRP Face Sheets

1. Through color.

a. Colors as selected by architect from the manufacturers full range including standard, premium and custom colors.

C. Face Sheet: SL-18 face sheets authentic oak species wood grain replication FRP.

1. Use for all SL- 18

2. Color: As selected from full range of manufacture's colors including standard, premium and custom colors.

D. Frame:

1. Aluminum.

a. Paint:

a) Fluoropolymer Two-Coat System: KYNAR

(a) Topcoat: 70% KYNAR or HYLAR® 5000 meets or exceeds all AAMA 2605 specifications, 2.5 to 4.0 wet mils,1.00 to 1.20 dry mils.

(b) Colors: As selected by Architect from manufacturer's standard colors.

2.7 HARDWARE

A. Provide and factory install finish hardware for each door leaf as specified in Section 08 7100 - Door Hardware.

1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

B. Pull

1. Special-Lite SL-82 Clear Anodized Class I Aluminum Recessed Pull Handles.

C. Special-Lite SL-301 Concealed adjustable brush. Install door manufacturer’s multi-directional adjustable bottom with double nylon brush weatherstripping. Door bottom must be concealed and adjust to accommodate irregular tapered floor conditions.

D. Concealed Adjustable Meeting Stile Astragal at Pairs of Doors. Install door manufacturer’s adjustable astragal with double pile weather seal weatherstripping.

E. Receive Hardware supplied in accordance with this Section, and coordinate with the Hardware requirements of this section. Report discrepancies (in writing) to the Architect immediately.

F. Reinforce, cut, drill and tap doors and frames as required to receive Hardware, except do not drill and tap for surface mounted closers and holders, which will be applied at the jobsite. Comply with Hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

G. Install all Hardware, except surface mounted closers, holders, gaskets and seals at the fabrication plant. Remove only Hardware as required for final finishing or delivery to jobsite. Package and identify such Hardware and ship with doors and frames for installation at the project site.

H. Painting: All existing surfaces to remain exposed, and all disturbed areas shall be painted to match existing surfaces.

I.

2.8 ACCESSORIES

A. Foam window and door seal.

1. Fill all exterior joint between windows and doors solid in accordance with manufacture's instructions.

2. Cut back to permit application of joint sealant.

3. Insulating-Foam Sealant: Dow Great Stuff Window & Door.

B. Stops for Glazing: Fiberglass, unless otherwise indicated or required by fire rating; provided by door manufacturer to fit factory made openings, with color and texture to match door; fasteners shall maintain waterproof integrity.

1. Exterior Doors: Provide non-removable stops on exterior side with continuous compression gasket weatherseal.

2. Glazed Openings: Provide removable stops on interior side.

3. Opening Sizes and Shapes: As indicated on drawings.

C. Snap Trim as required. Match door and frame finish.

D. Lite Kits:

1. Factory Glazing:

a. Provide and factory install FL-SecureLite. 2 piece extruded aluminum Class I Clear Anodized Lite Kit. Provide as per the drawings.

b. Glazing Thickness: 1"

2. Rectangular Vision Lite Accessories.

a. Size, as indicated on drawings.

3. Size as indicated on drawings.

4. Factory Glazing: Refer to Section 08 8000 - Glazing.

2.9 FABRICATION

A. Factory Assembly.

1. Door and frame components from the same manufacturer.

2. Required size for door and frame units, shall be as indicated on the drawings.

3. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.

4. All cut edges to be free of burs.

5. Welding of doors or frames is not acceptable.

6. Maintain continuity of line and accurate relation of planes and angles.

7. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

B. Shop Fabrication

1. All shop fabrication to be completed in accordance with manufactures process work instructions.

2. Quality control to be performed before leaving each department.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.

B. Notify Construction Manager of conditions that would adversely affect installation or subsequent use

C. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Ensure openings to receive frames are plumb, level, square, and in tolerance

C. Notify Construction Manager of conditions that would adversely affect installation or subsequent use

D. Clean and prepare substrate in accordance with manufacturer's directions.

E. Protect adjacent work and finish surfaces from damage during installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Install exterior doors in accordance with ASTM E2112.

C. Install door hardware as specified in Section 08 7100.

D. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

E. Anchor frames securely in place.

F. Install exterior doors to be weathertight in closed position.

G. Set thresholds in continuous bed of sealant.

H. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints; fill jambs with grout as walls are laid up.

I. In stud walls, install frames prior to building walls; anchor frames to studs using concealed anchors.

J. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

K. Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by Construction Manager.

L. Repair or replace damaged installed products that cannot be successfully repaired as determined by Construction Manager.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's representative shall provide technical assistance and guidance for installation of doors and provide written report.

3.5 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.6 CLEANING

A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration until Date of Substantial Completion.

B. Provide protective treatment and other precautions required through the remainder of the construction period, to ensure that the doors and frames will be without damage or deterioration (other than normal weathering) at the time of acceptance.

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.3 RESPONIBILITY AND REQUIREMENTS

A. Each Contractor shall provide access doors for all dampers, valves, cleanest, junction boxes, pull boxes or similar items located above finished ceilings or ceiling breaks or extensions, behind finished walls or below finished floors. The access doors shall be steel, unless noted otherwise, hinged types as required for type of construction.

1. Where feasible locate all dampers, valves, cleanest, junction boxes, pull boxes or similar items above acoustical panel tile ceilings.

B. In new walls, floor, ceiling, etc., access doors are to be installed by the General Construction Contractor and furnished by each Contractor whose work requires access.

C. Access door required in existing walls, floors, ceilings, etc., shall be furnished and installed by the contractor requiring access.

1.4 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Access doors in gypsum walls.

B. Section 09 9123 - Interior Painting: Field paint finish.

1.5 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

C. ITS (DIR) - Directory of Listed Products; current edition.

D. UL (FRD) - Fire Resistance Directory; Current Edition.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of each access unit.

1.7 QUALITY ASSURANCE

PART 2 PRODUCTS

2.1 GENERAL:

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

B. Sizes shall be 12 X 12 inch at easily accessible valves and cleanouts; 18 X 18 inch where partial body access is required; 24 X 24 inch where entree body access is necessary.

C. Group together concealed boxes, control valves, dampers and other mechanical and electrical equipment requiring access for operation, maintenance and repair, to reduce number of access doors required.

D. Where electric motors or heaters are installed above hung ceilings, provide disconnect switch in hung ceilings within reach from access doors, unless switch is located on wall immediately below.

1. Disconnect switch shall be provided and installed by the Contractor furnishing the equipment unless shown otherwise.

E. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

F. All access doors shall have integral casing bead, white enamel prime coat, reinforced panel, flush type tamper proof lock unless noted otherwise.

G. All access doors in Janitor Closets, Science and Prep Rooms, and Storage Rooms and similar spaces shall be watertight and constructed completely of stainless steel type 304.

2.2 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:

1. Location: As required.

2. Panel Material: Steel. Painted

3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

5. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

B. Wall-Mounted Units in Wet Areas:

1. Location: As required.

2. Material: Stainless steel, Type 304.

3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

5. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

C. Fire-Rated Wall-Mounted Units:

1. Wall Fire-Rating: Fire rating equivalent to the fire rated assembly in which they are to be installed..

a. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.

2. Panel Material: Steel. Painted

3. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

D. Ceiling-Mounted Units:

1. Location: As required.

2. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.

3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.

4. Size: As required

5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

E. Manufacturers:

1. Milcor, Inc: www.milcorinc.com/#sle.

2. Substitutions: Section 01 2500 Substitution Procedures

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Construction Manager of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Hardware for wood, hollow metal, and FRP doors.

B. Hardware for fire-rated doors.

C. Thresholds.

D. Smoke and draft control seals.

E. Weatherstripping and gasketing.

1.3 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 1613 - Fiberglass Doors And Aluminum Frames.

C. Section 28 1000 - Access Control: Electronic access control devices.

1.4 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

C. BHMA A156.3 - American National Standard for Exit Devices; 2014.

D. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

E. BHMA A156.6 - American National Standard for Architectural Door Trim; 2015.

F. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2013.

G. BHMA A156.21 - American National Standard for Thresholds; 2014.

H. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2017.

I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

J. DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.

K. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

L. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

N. ITS (DIR) - Directory of Listed Products; current edition.

O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

Q. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

T. UL (DIR) - Online Certifications Directory; Current Edition.

U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:

1. Fuller and D'Angelo, P.C. .

2. Installer's Architectural Hardware Consultant (AHC).

3. Hardware Installer.

4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:

1. Attendance Required:

a. Edgemont Union Free School District.

b. Fuller and D'Angelo, P.C. .

c. Installer's Architectural Hardware Consultant (AHC).

d. Door Hardware Installer.

2. Agenda:

a. Establish keying requirements.

b. Verify locksets and locking hardware are functionally correct for project requirements.

c. Verify that keying and programming complies with project requirements.

d. Establish keying submittal schedule and update requirements.

3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:

4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Fuller and D'Angelo, P.C. , Edgemont Union Free School District, participants, and those affected by decisions made.

5. Deliver established keying requirements to manufacturers.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).

2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.

a. Submit in vertical format.

3. Include complete description for each door listed.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).

2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.

3. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.

E. Samples for Verification:

1. Submit minimum size of 2 by 4 inch for sheet samples, and minimum length of 4 inch for other products.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Supplier's qualification statement.

J. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

K. Keying Schedule:

1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Edgemont Union Free School District's name and registered with manufacturer.

M. Maintenance Materials and Tools: Furnish the following for Edgemont Union Free School District's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.7 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Fuller and D'Angelo, P.C. and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.9 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Edgemont Union Free School District's name and register with manufacturer.

1. Closers: Five years, minimum.

2. Exit Devices: Three years, minimum.

3. Locksets and Cylinders: Three years, minimum.

PART 2 PRODUCTS

2.1 General Requirements

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Locks: Provide a lock for each door, unless it's indicated that lock is not required.

1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.

2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

3. Strikes:

a. Finish: To match lock or latch.

b. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.

c. Center Strike At Pairs of Doors: 7/8 inch lip.

D. Thresholds:

1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.

E. Smoke and Draft Control Seals:

1. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

F. Weatherstripping and Gasketing:

1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.

2. Provide door bottom sweep on each exterior door, unless otherwise indicated.

G. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

H. See Section 28 1000 for additional access control system requirements.

I. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.

a. Aluminum fasteners are not permitted.

b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.

2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.

a. Self-drilling (Tek) type screws are not permitted.

3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.

4. Provide wall grip inserts for hollow wall construction.

5. Fire-Resistance-Rated Applications: Comply with NFPA 80.

a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.

2.2 PERFORMANCE Requirements

A. Provide door hardware products that comply with the following requirements:

1. Applicable provisions of federal, state, and local codes.

a. NYS Building Code/ICC (IBC).

b. NFPA 101.

2. Accessibility: ADA Standards and ICC A117.1.

3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or _____ as suitable for application indicated.

5. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.

6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.

7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.

8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.3 EXIT DEVICES

A. Properties:

1. Actuation: Full-length touchpad.

2. Chassis:

   a. Construction: Investment cast steel, zinc dichromate plated.

   b. Compatibility: Standard Stile doors.

3. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.

4. Latch Bolts: Stainless steel deadlocking with 3/4 inch projection using latch bolt.

5. Lever Design: Match project standard lockset trims.

6. Cylinder: Include where cylinder dogging or locking trim is indicated.

7. Strike as recommended by manufacturer for application indicated.

8. Sound dampening on touch bar.

9. Dogging:

   a. Non-Fire-Resistance-Rated Devices: Cylinder 1/4 inch dogging.

   b. Fire-Resistance-Rated Devices: Manual dogging not permitted.

10. Touch bar assembly on wide style exit devices to have a 1/4 inch clearance to allow for vision frames.

11. All exposed exit device components to be of architectural metals and “true” architectural finishes.

12. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.

13. Vertical Latch Assemblies' Operation: Gravity, without use of springs.

14. Provide flush end caps.

B. Grades: Complying with BHMA A156.3, Grade 1.

1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

C. Options:

1. Furnish less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.

2.4 LOCK CYLINDERS

A. Properties:

1. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.

a. Provide cams and/or tailpieces as required for locking devices.

b. Provide cylinders with appropriate format interchangeable cores.

2.5 CLOSERS

A. Manufacturers:

B. Properties:

1. Surface Mounted Closers: Manufacturer's standard.

a. Construction: R14 high silicon aluminum alloy.

b. Pinion: Stainless steel.

c. Hydraulic Fluid: All-weather type.

d. Arm Assembly: Standard for product specified.

a) Material: Steel.

b) Parallel arm to be a heavy-duty rigid arm.

e. Covers:

a) Type: Standard for product selected.

b) Material: Metal.

c) Finish: Painted.

d) Attachment: Two-point flange mounting, dual-clamp friction fit closer cover.

C. Grades:

1. Closers: Comply with BHMA A156.4, Grade 1.

a. Underwriters Laboratories Compliance:

a) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.

D. Types:

1. Rack-and-pinion, surface-mounted. 1-1/2 inches minimum bore.

E. Options:

1. Delayed action, adjustable with an independent valve.

F. Installation:

1. Mounting: Includes surface mounted installations.

2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.

3. At outswinging exterior doors, mount closer on interior side of door.

4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.

5. Mount closers to allow full 180 deg swing of doors,unless specified for integral stop.

G. Products:

1. Surface Mounted:

a. 8916

2.6 PROTECTION PLATES

A. Manufacturers:

1. Trimco: www.trimcohardware.com/#sle.

B. Properties:

1. Plates:

a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.

b. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.

1. Metal Properties: Stainless steel.

E. Installation:

1. Fasteners: Countersunk screw fasteners

2.7 STOPS AND HOLDERS

A. Manufacturers:

1. Trimco: www.trimcohardware.com/#sle.

B. Grades:

1. Door Holders, Wall Bumpers, Floor Stops, and Dome Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

C. Material: Base metal as indicated for each item by BHMA material and finish designation.

D. Types:

1. Floor Stops: Provide with bumper floor stop.

2.8 THRESHOLDS

A. Properties:

1. Threshold Surface: Fluted horizontal grooves across full width.

B. Grades: Thresholds: Comply with BHMA A156.21.

C. Material: Base metal as indicated for each item by BHMA material and finish designation.

1. Threshold Assemblies: Aluminum.

D. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.

2.9 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:

B. Properties:

1. Weatherstripping Air Leakage Performance: Not exceeding 0.3 cfm/sq ft of door opening at 0.3 inches of water pressure differential for single doors, and 0.5 cfm/sq ft of door area at 0.3 inches of water pressure differential for double doors for gasketing other than smoke control, as tested according to ASTM E283/E283M; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

2. Adhesive-Backed Perimeter Gasketing: Slilicone gasket material applied to frame with self-adhesive.

C. Grades: Comply with BHMA A156.22.

D. Products:

2.10 FINISHES

A. Finishes: Identified in Hardware Sets.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.

1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.

2. Mounting heights in compliance with ADA Standards:

   a. Locksets: 40-5/16 inch.

   b. Push Plates/Pull Bars: 42 inch.

   c. Exit Devices: 40-5/16 inch.

J. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

K. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 4000 - Quality Requirements.

B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4 ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.5 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.6 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution.

B. Do not permit adjacent work to damage hardware or finish.

3.7 HARDWARE SCHEDULE

A. See specification section 08 7100.01 for hardware sets.

Hardware Sets

SET #01 – each opening to have:

1	Continuous Hinge	662HD-UL x HEIGHT REQUIRED	AL	ST
1	Exit Device	2103 CD	630	TR
2	Cylinders	BEST CYLINDERS AND CORES AS REQUIRED	626	BE
1	Door Pull	BY DOOR MFGR		
1	Closer	8916 505T PUSH SIDE MOUNT STOP ARM HOLD OPEN	689	DM
1	Electric Strike	F2164	630	BE
1	Card reader	RC-04 PRX-M	1S0NAS	
1	Door Position Switch	CONCEALED MAGNETIC SWITCH		
1	Power Supply	ELR152	PR	
1	Request to Exit			
1	Seals/Weatherstripping	PERIMETER SEALS BY DOOR MANUFACTURER		
1	Threshold	655A-223	ZER	
1	Kick Plate	KO050 8" x 2" LDW B4E C-SUNK HOLES	630	TR

NOTE: FRP Opening. Coordinate with FRP Door Supplier for hardware being supplied as part of FRP manufacturer's package.
NOTE: Access Control devices, Door Position Switches, Power Supplies and related accessories shall be coordinated with the Owner's Security Vendor. Prep door and frame for door position switch, as required.
Coordinate wiring with all trades.
OPERATION: Proper credential presented to access control reader retracts electric strike for access.
Access also by key. Always free egress. FRP Opening.

SET #02 – each opening to have:

2	Continuous Hinge	662HD-EPT PREP x HEIGHT REQUIRED	AL	ST
1	Set Automatic Flush Bolts	3810 X 3810	626	BE
1	Classroom Function Lockset	9K3-7R15C PATD	626	BE
2	Kick Plates	KO050 8" x 2" LDW B4E C-SUNK HOLES	630	TR
1	Dust Proof Strike	3910	630	TR
1	Gasketing	5050 B @ HEAD AND JAMBS		NA
1	Meeting Astragel	5070 CL X HEIGHT AS REQUIRED		

SET #03 – each opening to have:

1	Continuous Hinge	662HD UL x HEIGHT REQUIRED	AL	ST
1	Storeroom Function	9K3-7DI5C PATD	626	BE
1	Kick Plate	KO050 8" x 2" LDW B4E C-SUNK HOLES	630	TR
1	Mop Plate	KM050 4" x 1" LDW CSK B4E	630	TR
1	Dome Stop (Door Sp-101)	1211	626	TR
1	Overhead stop (Door Sp-102)	OH105H HEAVY DUTY CONCEALED	630	ROKWD
3E	Silencer	SR64-GRY		IVES

SET #04 – each opening to have:

1	Continuous Hinge	662HD UL x HEIGHT REQUIRED	AL	ST
1	Storeroom Function	9K3-7DI5C PATD	626	BE
1	Closers	8916 AF89P PUSH SIDE MOUNT	689	DM
1	Kick Plate	KO050 8" x 2" LDW B4E C-SUNK HOLES	630	TR
1	Concealed HD Overhead Stop	9105 x LENGTH REQUIRED	DM	
1	Seals/Weatherstripping	PERIMETER SEALS BY DOOR MANUFACTURER		
1	Threshold	655A-223	ZER	BY

NOTE: Coordinate templating of overhead stop with door closer for proper function of opening.
NOTE: FRP Opening. Coordinate with FRP Door Supplier for hardware being supplied as part of FRP manufacturer's package.

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Insulating glass

B. Laminated glass.

C. Fire rated safety glass.

D. Glazing compounds and accessories

1.3 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites installed in doors and borrowed lites.

1.4 DEFINITIONS

A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.5 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).

D. ASTM C1036 - Standard Specification for Flat Glass; 2016.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2018c.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

J. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2017.

K. ASTM E 2188 – Standard Test Method for Insulating Glass Unit Performance and Evaluation.

L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

M. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.

N. GANA (SM) - GANA Sealant Manual; 2008.

O. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

P. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.

R. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

S. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

T. New York State Section 2406 Safety Glazing.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data for each glass product and glazing material indicated. Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Samples: Submit 6 inch long bead of glazing sealant, color as selected.

F. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

G. Certificate: Certify in writing and signed by manufacturers that products of this section meet or exceed specified requirements.

H. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Edgemont Union Free School District's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Sustainable Design Certification: Glass shall be Cradle to Cradle Certified™, minimum Silver Level, Cradle to Cradle Innovation Institute.

B. Perform Work in accordance with GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Manufacturers Alliance

D. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, Insulating Glass Manufacturers Alliance ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

2. Lites more than 9 square feet (sf) (0.84 sq. m) in area are required to be Category II materials

E. Where glazing units, including Kind FT glass, are specified in Part 2 articles for glazing lites more than 9 sf in area, provide glazing products that comply with Category II materials, and for lites 9 sf or less in area, provide glazing products that comply with Category I or II materials.

F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum Ten (10) years of documented experience and meet ANSI / ASQC Q9002 1994.

G. Fabricator Qualifications: Manufactured Certified as acceptable to the manufacturer

H. Installer Qualifications: Company specializing in performing work of the type specified and with at least five (5) years documented experience and approved by manufacturer.

1. Manufacture shall provide field inspection of the installation.

2. An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

I. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type:

1. Insulating glass.

J. Source Limitations for Laminated Glass: Obtain laminated-glass units from one manufacturer using the same type of glass lites and interlayers for each type of unit indicated.

K. Source Limitations for Insulating Glass: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.

1. Insulating Glass products are to by permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:

    a. Insulating Glass Certification Council (IGCC).

    b. Single Source fabrication responsibility: All fabrication processes, including Low E and reflective coatings, insulating, laminating, silkscreen, and tempering, shall be fabricated by a single Fabricator.

L. Insulating Glass products are to by permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:

1. Insulating Glass Certification Council (IGCC).

2. Single Source fabrication responsibility: All fabrication processes, including Low E and reflective coatings, insulating, laminating, silkscreen, and tempering, shall be fabricated by a single Fabricator.

M. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.8 MOCK-UPS

A. See Section 01 4000 - Quality Requirements and individual sections for additional mock-up requirements.

B. Provide on-site glazing mock-up with the specified glazing components.

C. Locate where directed.

D. Mock-ups may remain as part of the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer’s written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including replacement of failed units.

D. Fire rated glazing: 5 year manufacturers standard coverage warranty.

E. Coated-Glass Products: Manufacturer's standard form, made out to the glass fabricator, in which the coated glass manufacturer agrees to replace coated glass units that deteriorate during normal use within the specified warranty period. Deterioration of the coated glass is defined as peeling and/or cracking, or discoloration that is not attributed to glass breakage, seal failure, improper installation or cleaning and maintenance that is contrary to the manufacturer's written instructions.

1. Warranty Period:five (5) from date of Substantial Completion

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Rated Safety Glass conforming to Underwriters Laboratories, Inc. Fire Tests of Door Assemblies and the following:

1. Firelite Plus, clear ceramic laminated with 2 pieces of Premium Lite and a proprietary interlayer specialty high impact fire rated glazing material.

a. Thickness: 5/16"

b. Provide Safety film as specified in Section 08 9717.

c. U Value: 0.40

d. Weight: 3.8-lbs/sq. ft.

e. Sound Transmission Rating: 38 STC

f. Glazing materials shall be optically clear, colorless and free from usual distortion.

g. Each piece of fire-rated glazing material shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory fire rating period and safety glazing standards.

h. Glazing material installed shall be certified and permanently labeled as meeting applicable requirements referenced in NFPA 80 and:

i. ANSI Z97.1

j. CPSC 16 CFR 1201, Category II 400 ft.lbs.

k. Glazing shall be installed in a rated framing system meeting ASTM E2010-01, NFPA 257, UL 9, UBC 7-4 or CAN4-S106 and ASTM E2074-00, NFPA 252, UL 10b, UBC 7-2 or CAN4-S104

2. Use for all interior vision panels in fire rated doors, transoms in fire rated door assemblies, and glass within 18" above the floor.

2.2 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.

2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.

    a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

    b. For uncoated glass, comply with requirements for Condition A.

    c. For coated vision glass, comply with requirements for Condition C (other uncoated glass).

3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

B. Laminated Glass Manufacturers: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.3 INSULATING GLASS UNITS GENERAL

A. Manufacturers:

1. Vitro Architectural Glass (formerly PPG Glass); Solarban 60: www.vitroglazings.com/#sle.

B. Insulating Glass Units: Types as indicated.

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.

2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.

3. Warm-Edge Spacers: Low-conductivity thermoplastic with desiccant warm-edge technology design.

    a. Spacer Width: As required for specified insulating glass unit.

    b. Spacer Height: Manufacturer's standard.

4. Spacer Color: Black.

5. Edge Seal:

    a. Single-Sealed System: Provide silicone, polysulfide, or polyurethane sealant as seal applied around perimeter.

6. Color: Black.

7. Purge interpane space with dry air, hermetically sealed with argon gas.

C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.

1. Applications: Exterior glazing unless otherwise indicated.

2. Space between lites filled with air.

3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.

   a. Tint: Clear.

4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.

   a. Tint: Clear.

5. Total Thickness: 1 inch.

6. Thermal Transmittance (U-Value), Summer - Center of Glass: _____, nominal.

D. Space between lites filled with gas as required to maintain Thermal Transmittance Overall U-value.

E. Total Thickness: 1 inch.

F. Solar Heat Gain Coefficient (SHGC): 0.38, nominal.

G. Spacer Color: Black.

H. Edge Seal:

1. Single-Sealed System: Provide silicone, polysulfide, or polyurethane sealant as seal applied around perimeter.

2. Color: Black.

3. Purge interpane space with dry air, hermetically sealed with Argon gas.

2.4 GLASS TYPES

A. **Monolithic Interior Non-Rated Vision Glazing:**

1. Applications: As scheduled.

2. Glass Type: Laminated float glass.

3. Tint: Clear.

4. Thickness: 1/4 inch, nominal.

5. Interlayer: Polyvinyl butural (PVB) Thickness as required to meet performance requirements.

6. Use for all non-rated interior door sidelights and all interior glass within 18" above the finished floor.

7. Refer to Section 01 2500 - Substitution Procedures

2.5 GLAZING COMPOUNDS

A. As reccommended by the manufacturer.

2.6 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

1. Width: As required for application.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements

2.8 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements and individual sections requirements.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.2 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 GLAZING SYSTEM:

A. Manufacturer's standard factory-glazing system that produces weather tight seal.

3.5 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove nonpermanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.7 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.8 SCHEDULE

A. Refer to drawings schedule and drawings for location and/or requirements.

SECTION 08 9100
LOUVERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.3 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry for brick veneer.

B. Section 05 5000 - Metal Fabrications for lintels.

C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.4 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

D. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum five (5) years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of experience.

C. Welding: Qualify procedures and personnel according AWS D1.2, "Structural Welding Code--Aluminum."

D. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Wind Load Resistance: Design to resist positive and negative wind load of 40 psf without damage or permanent deformation.

2. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.

3. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction.

1. Free Area: 54.2, minimum.

2. Static Pressure Loss: 0.12 inch wg maximum per square foot of free area at velocity of 700 fpm, when tested in accordance with AMCA 500-L.

3. Blades: Drainable.

4. Frame: 4 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.

5. Aluminum Thickness: Frame 12 gage, 0.0808 inch minimum; blades 12 gage, 0.0808 inch minimum.

6. Product: Use the following : Airolite K6744 with flange at wall louvers.

   a. Substitutions: See Section 01 2500 Substitution Procedures.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.

2.4 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

   1. Manufacturers:

      a. PPG; Duranar: www.ppgmetalcoatings.com/#sle.

      b. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.

      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Color: Selected by architect from manufacturers full range of standard and premiium colors..

2.5 ACCESSORIES

A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1-1/2 inch thick, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct. Coordinated with Mechanical Contractor.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch diameter wire, 1/2 inch open weave, diagonal design.

D. Insect Screen: 18 x 16 size aluminum mesh.

E. Window and Door Joint Seal: Polyurethane-based joint filler:

   1. UL Classified.

   2. Product: "Great Stuff" as manufactured by Dow Chemical.

      a. "Gaps and Cracks: for joints less than 1".

b. "Big Gap Filler" for joint over 1".

3. Use for all filling all spaces and joints around louvers located on exterior walls.

F. Sealant: Type, as specified in Section 07 9200 - Joint Sealants.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Coordinate with installation of flashings by others.

C. Install louvers level and plumb.

D. Set sill members and sill flashing in continuous bead of sealant.

E. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

F. Secure louver frames in openings with concealed fasteners.

G. Install perimeter sealant and backing rod in accordance with 07 9200 - Joint Sealants.

H. Coordinate with installation of mechanical ductwork.

3.3 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel soffit/ceiling framing.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 4000 - Cold-Formed Metal Framing:

C. Section 06 1000 - Rough Carpentry: Wood blocking.

D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

E. Section 07 8400 - Firestopping: Top-of-wall assemblies and penetrations at fire rated walls.

F. Section 07 9200 - Joint Sealants.

G. Section 09 3000 - Tiling.

H. Section 09 7700 - Plastic Wall Surfaces.

1.4 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Framing - Nonstructural Members; 2015.

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

F. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

G. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2014).

H. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014, with Editorial Revision (2015).

I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2017.

J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2018b.

K. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.

M. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

N. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.

O. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

P. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2018a.

Q. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2018.

R. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

T. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2018c.

U. ASTM E413 - Classification for Rating Sound Insulation; 2016.

V. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015.

W. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

X. UL (FRD) - Fire Resistance Directory; Current Edition.

Y. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.6 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum Ten (10) years of experience.

C. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of documented experience.

D. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

1.7 REGULATORY REQUIREMENTS

A. Refer to Section 01 4100 - Regulatory Requirements.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:

1. Fire Rated Partitions: Rating as indicated on the drawings..

2. Head of Fire-Resistance-Rated Partitions: UL listed assembly No. as indicated on drawings.

3. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.

4. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Manufacturers - Metal Framing, Connectors, and Accessories:

1. Marino: www.marinoware.com.

2. Substitutions: See Section 01 2500 Substitution Procedures

C. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Studs: C-shaped with knurled or embossed faces.

a. Minimum Base Metal Thickness: 16 gauge (54 mils) unless noted otherwise.

b. Depth: As indicated on drawings.

2. Runners: U shaped, sized to match studs.

3. Ceiling Channels: C-shaped.

4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.

5. Furring Members: U-shaped sections, minimum depth of 3/4 inch.

D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

F. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

1. Products:

a. ClarkDietrich; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com.

G. Flute Cover:

1. Corrugated strap for horizontal use to span flute areas of unprotected metal decks.

2. Products:

a. Clark Dietrich," (FC) Flute Cover.

a) Minimum 20 ga.

b) Non-structural.

b. Refer to Section 05 3000 Metal Deck for deck types,

H. Non-structural Framing Accessories:

1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.

3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

I. Soffit Framing

1. Manufacturere:

a. Armstrong

a) SimpleSoffit Drywall framing System. See drawings for details and locations.

2. Components, General: Comply with ASTM C 754 for conditions indicated.

3. Hangers:

a. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

4. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch-wide flange, with ASTM A 653, G40 (Z120), hot-dip galvanized zinc coating.

a. Depth: As indicated on drawings.

b. Gauge: 16 (54 mils) gauge unless shown otherwise.

2.3 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. Georgia-Pacific Gypsum: www.gpgypsum.com.

2. National Gypsum Company: www.nationalgypsum.com.

3. USG Corporation: www.usg.com.

4. Substitutions: See Section 01 2500 Substitution Procedures

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

a. **Mold resistant board is required at all locations.**

3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

4. Thickness:

    a. Vertical Surfaces: 5/8 inch

    b. Soffits and Ceilings: 1/2 inch.

C. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Soffits and ceilings, unless otherwise indicated.

2. Thickness: 1/2 inch.

3. Edges: Tapered.

4. Products:

    a. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board: www.gpgypsum.com/#sle.

2.4 GYPSUM WALLBOARD ACCESSORIES

A. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, unless noted otherwise.

1. Corner Beads: Low profile, for 90 degree outside corners.

    a. Products:

        a) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com.

2. L-Trim with Tear-Away Strip: Sized to fit the thickness gypsum wallboard.

    a. Products:

        a) Phillips Manufacturing Co; gripSTIK L-Tear: www.phillipsmfg.com.

3. Expansion Joints:

    a. Type: V-shaped metal with factory-installed protective tape.

    b. Products:

        a) Armstrong.

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Mold resistant and asbestos free.

2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

3. Products:

    a. USG Imperial Brand MH Tuf-Tape.

b. Substitutions: See Section 01 2500 Substitution Procedures

4. Joint Compound: Drying type, vinyl-based, ready-mixed.

a. Products:

a) USG Sheetrock Early setting MH Tuf-Set.

b) Substitutions: See Section 01 2500 Substitution Procedures

C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

D. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

E. Utility angle: 2"x 2" 20 ga. for attachments of intersection framing and right angle corner enclosures.

F. Flat straps: 6", 16 ga. use for stud bridging.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Provide metal Bracing: at midpoint up to 8' 0"; at third point over 8'-0".

C. Studs: Space studs at 16 inches on center, unless shown otherwise

1. Extend partition framing to structure in all locations.

2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs minimum 16 gauge.

E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 16 inches on center.

1. Orientation: Horizontal.

2. Spacing: At 16 inches on center.

F. Blocking: Install blocking for support of hardware. Comply with Section 06 1000 Rough Carpentry.

G. Suspended Ceiling and Soffits: Space framing and furring members as indicated.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Place one bead continuously on substrate before installation of perimeter framing members.

2. Place continuous bead at perimeter of each layer of gypsum board.

3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.4 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

1. Seal joints, cut edges, and holes with water-resistant sealant.

2. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

F. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. Corner Beads: Install at external corners, using longest practical lengths.

B. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.

2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.

2. Taping, filling, and sanding are not required at base layer of double-layer applications.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.7 FIRE RATED WALL MARKING AND IDENTIFICATION

A. For all walls or partitions indicated to be fire rated, or smoke rated, where there is an accessible concealed floor, ceiling or attic space adjacent to said wall. Contractor shall permanently mark with signs or stenciling within he concealed space, in accordance with IBC 703.7 in concealed spaces.

1. Identifications shall be located within 15 feet of the end of each wall or partition and at intervals not exceeding 30 feet measured horizontally along the wall or partition.

2. Identifications shall include lettering not less than 3 inches in height with a minimum 3/8 inch stroke width in a contrasting color incorporating the wording " FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS".

3.8 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.9 FINISH LEVEL SCHEDULE

A. Level 1: Above finished ceilings concealed from view.

B. Level 2: Utility areas and areas behind cabinetry.

C. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.

D. Level 5: Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

SECTION 09 3000
TILING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Preparation.

B. Tile for wall applications.

C. Ceramic accessories.

D. Ceramic trim.

E. Non-ceramic trim.

1.3 RELATED REQUIREMENTS

A. Section 03 5400 - Cast Underlayment.

B. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.4 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2017.

1. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).

2. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.

3. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar; 2012 (Revised).

4. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile; 2008 (Reaffirmed 2013).

5. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2012.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2017.

E. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2017.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's Qualification Statement:

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

G. Maintenance Materials: Furnish the following for Edgemont Union Free School District's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.7 MOCK-UPs

A. See Section 01 4000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up incorporating all components specified for the location.

1. Minimum size of mock-up is 10' x 10'.

2. Approved mock-up may remain as part of work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.1 TILE

A. Glazed Wall Tile: ANSI A137.1 standard grade and as follows:

1. Sizes: As indicated on drawings.

2. Edges: Cushioned.

3. Color(s): As indicated on drawings.

4. Trim Units: Matching bullnose shapes in sizes coordinated with field tile.

5. Products:

a. Dal-Tile Corporation; Classic and Linear Series: www.daltile.com.

6. Substitutions: Section 01 2500 Substitution Procedures.

2.2 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Ceramic Trim: Matching bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.

1. Applications:

a. Open Edges: Bullnose.

b. Inside Corners: Jointed.

c. Floor to Wall Joints: Cove base.

2. Manufacturers: Same as for tile.

C. Non-Ceramic Trim: Brushed stainless steel, style and dimensions as indicated on drawings, for setting using tile mortar or adhesive.

1. Applications: Refer to Finish Schedule for types and finish.

a. SCH-1, ECK-E/8-E37D2A EB 80/300

1. Corner Guard

b. SCH-2, RONDEC-AC

1. Wall tile Edge Termination

2. Manufacturers:

a. Schluter-Systems: www.schluter.com.

b. Substitutions: 01 6000 - Product Requirements.

D. Thresholds: opening width by full depth of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.

1. Thickness: 1/2 inch.

2. Material: Marble, honed finish.

3. Color and Pattern: As indicated on drawings.

4. Applications:

a. At toilet doorways where tile terminates and as indicated on drawings.

2.3 SETTING MATERIALS

A. Manufacturers:

1. Mapei Corporation. Product: Ultralite Mortar Pro.

2. Substitutions: Section 01 2500 Substitution Procedures.

2.4 GROUTS

A. Manufacturers:

1. Mapei Corporation ; Product Ultracolor Plus FA.

a. Use for all areas

2. Substitutions: Section 01 2500 Substitution Procedures.

2.5 ACCESSORY MATERIALS

A. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers

B. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

1. Products: MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout

a. Provide sealer coat over all tile floors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).

1. Test as Follows:

a. Alkalinity (pH): ASTM F710.

b. Internal Relative Humidity: ASTM F2170.

c. Moisture Vapor Emission: ASTM F1869.

2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer and notify the Construction Manager.

3.2 PREPARATION

A. Protect surrounding work from damage.

3.3 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners neatly.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive. Refer to TCNA (HB) EJ 171 for location and frequency of joints.

K. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

M. Grout tile joints unless otherwise indicated.

N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

O. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.4 INSTALLATION - WALL TILE

A. Over cementitious backer units install in accordance with TCNA (HB) Method W223, organic adhesive.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.5 CLEANING

A. Clean tile and grout surfaces.

3.6 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Removals

B. New acoustical panels and suspended grid as required and indicated on drawings.

1.3 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements for coordination and coordination drawings.

B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. Section 07 9200 - Joint Sealants.

D. Section 09 2116 - Gypsum Board Assemblies.

E. Divisions 23 and 26 for air outlets and inlets, light fixtures, and fire alarm.

1.4 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2018.

C. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2017.

D. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

G. ASTM C841 - - Standard Specification for Installation of Interior Lathing and Furring

H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2018c.

K. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2017.

L. ASTM E1111/E1111M - Standard Test Method for Measuring the Interzone Attenuation of Open Office Components.

M. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

N. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum; 2016.

O. ICC ES AC 156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 12 x 12 inch in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 12 inches long, of suspension system main runner.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in New York.

B. Fire Performance: ASTM E84 surface burning characteristics. Flame Spread index 25 or less. Smoke development index 50 or less. (UL Labeled) Class A in accordance to ASTM E1264.

C. Fire Performance Details: Suspension ceiling components will feature markings of applicable testing and inspecting organization

D. Fire-Resistance: As specified in ASTM E119 and listed in the determined ceiling design in the Underwriters Laboratories Fire Resistance Directory.

E. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

F. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years documented experience.

G. Installers Qualifications: Company specializing in the installation of acoustical ceilings specified in this section with minimum 5 years documented experience.

H. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Owner’s Representative.

2. Do not proceed with remaining work until workmanship, color, and sheen are approved by. Owner’s Representative

3. Refinish mock-up area as required to produce acceptable work.

I. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

J. Pre-installation Conference: Conduct conference at Project site minimum one week before removal and installation. Agenda shall include project conditions, coordination with work of other trades, and layout of items which penetrate ceilings.

1.7 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements.

B. Deliver extra acoustical units for Owner's use in maintenance. Label and store where directed by the Construction Manager including codes used on the Drawings. Do not deliver to the Project site until the Construction Manager is prepared to receive and store maintenance materials.

1. Tile: Furnish 5 percent of total acoustic unit area of extra tile to Construction Manager.

2. Suspension System Components: Furnish 5 percent of each exposed component of the quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet conditions such as concrete, plaster, paint, and adhesives have been completed and cured.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect system components from excessive moisture in shipment, storage, and handling

1.9 WARRANTY

A. Warranty: Provide manufacturer's standard warranty against manufacturing defects in material or workmanship when installed in accordance with the current CISCA Handbook and ASTM C367.

1. Warranty Period: .

2. Acoustical Panel: 30 years

3. Suspension System: 40 years.

1.10 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Tiles/Panels:

1. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.

2. Substitutions: See Section 01 2500 - Substitution Procedures.

B. Suspension Systems:

1. Same as for acoustical units.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:

1. Refer to Section 01 4100 - Regulatory Requirements.

2.3 ACOUSTICAL UNITS

A. Acoustical Tile: Painted mineral fiber,ASTM E1264 Type III, Form:2, Pattern C F (NRCP) with the following characteristics:

1. Sizes: 24 by 24 inches and 24" x 48". See drawings for locations.

2. Thickness: 3/4 inches.

3. Light Reflectance: 82 percent, determined in accordance with ASTM E1264.

4. Ceiling Attenuation Class (CAC): 30, determined in accordance with ASTM E1264.

5. Sag/Humidity Resistance: Standard

6. Fire Performance: Class A.

7. Edge: Square.

8. Surface Color: As indicated on drawings.

9. Suspension System: Exposed grid.

10. Products:

a. Cashmere, High NRC.

b. Substitutions: See Section 01 2500 - Substitution Procedures.

2.4 SUSPENSION SYSTEM(S)

A. Manufacturers:

1. CertainTeed; EZ stab Classic System;Heavy duty.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, and perimeter moldings as required.

1. Materials:

a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

C. Materials:

1. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE 7 and ICC ES AC 156.

2. Main Tees and Cross Tees: All suspension main tee and cross tee components are manufactured from commercial quality steel with factory punched cross tee slots, hanger holes, and integral bayonet-style end couplings. Double web stitching. The main tees are capped with steel capping affixed to a flange and is coated with factory applied baked-on enamel paint.

3. Structural Classification Standard: ASTM C635/C635M Intermediate Duty.

D. Color: Standard white unless otherwise noted.

E. Perimeter Treatment Components:

1. Angle Moldings: Manufactured from 0.020” thick steel and finished identical to main tees and cross tees.

2.5 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

D. Perimeter Moldings: Same metal and finish as grid.

1. Minimum 7/8" horizontal flange

E. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 9200 - Joint Sealants.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.3 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Install in bed of acoustical sealant.

2. Use longest practical lengths.

D. Install metal acoustical ceiling suspension assemblies to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

E. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:

1. Cut to fit irregular grid and perimeter edge trim.

2. Make field cut edges of same profile as factory edges.

F. Install seismic clips or stabilizer bars as per code requirements.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 ADJUSTING AND CLEANING

A. Replace damaged or broken material, Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with mfg,, touch up procedures using touch up paint as required for small nicks and minor scratches in the surface, Remove and replace any work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

1. Provide touch up kit for Owner's use.

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Removals.

B. Crack repair.

C. Cast Underlayment.

D. Moisture mitigation membrane

E. Resilient tile flooring.

F. Rubber Flooring

G. Resilient base.

H. Installation accessories.

1.3 RELATED REQUIREMENTS

A. Section 02 - Asbestos Abatement

B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. Section 03 5400 - Cast Underlayment.

1.4 REFERENCE STANDARDS

A. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

B. ASTM D5116, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products

C. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2017.

D. ASTM E662, Standard Test Method for Specific Optical Density of Smoke Generated

E. by Solid Materials.

F. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006 (Reapproved 2018).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. d. Flexibility ASTM F137.

I. 410, Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement.

J. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.

K. ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring.

L. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2017.

M. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).

N. ASTM F1265, Standard Test Method for Resistance to Impact for Resilient Floor Tile.

O. ASTM F1304, Standard Test Method for Deflection of Resilient Floor Tile.

P. ASTM F1514: Standard Test Method for Measuring Heat Stability of Resilient Flooring by Color Change

Q. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

R. ASTM F1914, Standard Test Method for Short- Term Indentation and Residual

S. Indentation of Resilient Floor Covering

T. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015, with Editorial Revision (2016).

U. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2017.

V. ASTM F2055 - Standard Test Method for Size and Squareness of Resilient Floor Tile by Dial Gage Method

W. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs.

X. ASTM F2199, Standard Test Method for Determining Dimensional Stability of Resilient

Y. Floor Tile after Exposure to Heat

Z. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

AA. NFPA 258, Research Test Method for Determining Smoke Generation of Solid Materials.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate floor patterns.

D. Verification Samples: Submit two samples, 12" x 12" in size illustrating color and pattern for each resilient flooring product specified.

E. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

H. Installer's Qualification Statement.

I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

J. MSDS (Material Safety Data Sheets) should be submitted for all adhesives used:

1. Membrane, primer, patch, leveler, heat weld rod, cold weld, liquid wax and cleaning agents

K. Maintenance Materials: Furnish the following for 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Materials: Furnish one box of tile for each fifty boxes or fraction thereof, for each type, color, pattern and size of the tile installed, from same manufactured lot as materials installed.

a. Deliver extra tile to Owner after completion of work.

b. Furnish tiles in protective packaging with identifying labels.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum 10 years documented experience, with resilient flooring of types equivalent to those specified.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

D. Field Samples per Section 01 4000 - Quality Requirements: Provide field samples, dry laid, to demonstrate aesthetic effects of materials in situ, assisting the Architect and Owner in making final selections

1.7 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions

1.8 MOCK UP

A. Field Samples per Section 001 4000 - Quality Requirements. Provide field samples, dry laid, to demonstrate aesthetic effects of materials in place.

1.9 FIELD CONDITIONS

A. Store materials for not less than 48 hours before, during, and 72 hours after installation, in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.10 PRE-INSTALLATION TESTING

A. Conduct pre-installation testing as follows:

1. ASTM F-2170 Test Method for Determining Relative Humidity in Concrete: Maximum RH: 55%.

1.11 WARRANTY

A. Provide manufacturer's non-prorated ten year limited warranty to be free from defects in material and workmanship, under normal use and service, to repair or replace all defective tiles including reasonable labor.

PART 2 PRODUCTS

2.1 TILE FLOORING

A. Homogeneuous Vinyl Tile: HVT 1,2 & 3

1. Manufacturer: Mohawk Group
2. Product:Creative Terrain
3. Size: As indicated on Finish Schedule
4. Color: As noted on drawings.
5. Performance:
    a. Classification: ASTM F1700 Class I; Type A
    b. Squareness: ASTM F2055 - Passes - ±0.10" max
    c. Thickness: ASTM F386 - Passes - as specified ±0.005"
    d. Flexibility: ASTM F137 - Passes - 1" mandrel
    e. Dimensional Stability: ASTM F2199 - Passes - 0.020"/linear foot max
    f. Static Load: ASTM F970 - Passes, modified at 2500 psi

g. Residual Indentation: ASTM F1914 - Passes - Average less than 8%

h. Slip Resistant: ASTM C1028 - Passes Wet: ?0.5

i. Resistance To Chemicals: ASTM F925 - Passes - No more than a slight change

j. Resistance To Light: ASTM F1515 - Passes -?E <8

k. ASTM F1514 - Passes -?E <8

l. Resistance To Heat: ASTM F1514 - Passes -?E <8

m. Critical Radiant Flux: ASTM E648 - Class 1 (>0.45 W/cm2)

n. Smoke Density: ASTM E662 Part A - Passes, Less than 450, both

o. Seams: Weld rod. Colors as noted on drawings.

B. Installation Material

1. Moisture vapor emission control: Ardex MC Rapid.

2. Adhesives/Primers: As recommended by the manufacturer.

3. Cove Base Accessories:

a. Angle Profile

4. Floor Polish.

C. Rubber Tile: Homogeneous, color and pattern throughout thickness.

1. Manufacturers:

a. C.I. Takiron.

b. Substitutions: 01 2500 - Substitution Procedures.

2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.

3. Size: As indicated on drawings nominal.

2.2 STAIR COVERING

A. Stair Treads and Risers: Rubber; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 0.18 inch deep.

1. Manufacturers:

a. C.I. Tackiron.

2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.

3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648.

4. Smoke Density: ASTM E 662/NFPA 258 , less than 450 .

5. Hardness: ASTM D 2240 - Not less than 85 Shore A.

6. Abrasion Resistance: ASTM D 3389 - less than 1 gram weight loss.

7. Slip Resistance: ASTM D 2047 - Meets or Exceeds a Static Coefficient of Friction (SCOF) of 0.8.

8. Nominal Thickness: 0.2" (5mm) inch. ASTM F386

9. Nosing: Square.

10. Striping: 2 inch wide contrasting color strips.

11. Depth: Verify existing.

12. Color: As indicated on drawings.

2.3 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and Style A straight for carpet installation as follows:

1. Manufacturers:

a. Johnsonite, a Tarkett Company: www.johnsonite.com.

b. Substitutions: See Section 01 2500 - Substitution Procedures.

2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.

3. Height: 4 inch.

4. Thickness: 0.125 inch.

5. Finish: Matte

6. Length: Roll.

7. Color: As indicated on drawings.

8. Accessories: Premolded external corners and internal corners.

2.4 ACCESSORIES

A. Subfloor Crack and Joint Repair: Two-part polyurethane repair compound

1. 100% solids for no shrinkage

2. Service temperature range of -35° to 110°F (-37° to 43°C),

3. Product:"Ardex ArdiFix", Ardex Engineered Cements, 400 Ardex Park Drive, Aliquippa, PA 15001 USA, Tel: 724-203-5000

B. Self-Drying, Cement-Based Finish Underlayment

1. Product: "Ardex Feather Finish®", Ardex Engineered Cements, 400 Ardex Park Drive, Aliquippa, PA 15001 USA, Tel: 724-203-5000.

C. Primers: Waterproof; types recommended by flooring manufacturer.

1. VOC Content Limits: As specified in Section 01 6116.

D. Adhesive for Vinyl Tile Flooring:

1. Adhesive shall be as recommended by the manufacturer, compatible with tile and substrate.

a. Note that recommendations shall be made which reflect and are compatible with the results of moisture level tests in the concrete substrate.

E. Moisture Control System: One-coat moisture control system that suppresses excessive moisture vapor emissions in existing concrete prior to the installation of finished flooring.

1. Product: Ardex MC Rapid, Moisture Control System, Ardex Engineered Cements, 400 Ardex Park Drive, Aliquippa, PA 1500, 888-512-7339, www.ardex.com.

2. If required, cost for mitigation contract will be adjusted by allowance as described in the Agreement.

F. Movement Joint: Vinyl tile flooring; Schluter:Dilex-EKSB-25-PG-V4A

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:

a. Internal Relative Humidity: ASTM F2170.

2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Moisture Testing: Moisture testing shall be performed using ASTM test method ASTM F 2170 Relative Humidity Test. The acceptable test result when using test method F 2170 should not exceed seventy five per cent (75%) AND pH readings should not exceed 9.0.

E. Verify that existing concrete sub floor do not containing curing compound by placing 1/4 cup of water on surface. If water beads up scarify surface.

F. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Concrete substrate that fully conforms to the requirements of ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring is required, or as detailed in the manufacturer's Installation Guide.

C. Crack and Joint Repair: Concrete must be structurally sound, solid, dry, and free of laitance, dirt, debris, coatings, sealers, solvent base adhesives and any contaminant that may act as a bond breaker.

1. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface up to 1/2".

2. Dry diamond blade may be used to prepare cracks and create a clean surface for bonding.

3. Do not use sweeping compounds, solvents or acid etching to prepare the surface.

4. Cracks or joints should be free of dust, dirt, oils and any other debris.

5. New concrete should be fully cured and free of movement.

6. Prohibit traffic until filler is fully cured.

D. Underlayment: All concrete substrates must be solid, thoroughly clean and free of oil, wax, grease, asphalt, latex and gypsum compounds, curing compounds, sealers and any contaminant that might act as a bond breaker.

1. **Mechanically profile with grinder 100% of all existing substrates receiving resilient flooring. Provide dust control as required.**

a. After profiling test substrate by place drop of water, or other means to insure all coatings, sealers etc have been removed. Repeat profiling if necessary.

3.3 INSTALLATION GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Crack and Joint Repair: During set-up of cartridge (purging air and balancing) and initial dispensing of material, keep cartridge and nozzle assembly pointed straight up to prevent material in the nozzle from flowing back into the cartridge.

1. Apply continuously once opened to prevent the tip from becoming clogged.

2. Immediately broadcast clean sand size #30 or #35 into the freshly applied material.

3. Fill the crack, joint or repair area so the material is slightly higher than the face of the concrete slab.

4. Allow to set for approximately 10 to 15 minutes (at 75° F), and then use a sharp razor scraper to shave excess material from the top of the slab.

D. Underlayment: Installed from a true featheredge up to 1/2 in. (12.7 mm).

1. Verify crack/joint repair has dried thoroughly.

2. Use the least amount possible to attain the desired smoothness.

3. Allow to dry in accordance to manufacturer's recommendations.

Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set as recommended by the manufacturer.

2. Fit joints and butt seams tightly.

3. Set flooring in place, press with heavy roller to attain full adhesion.

E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Resilient Strips: Attach to substrate using adhesive.

G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

H. Install flooring in recessed floor access covers, maintaining floor pattern.

I. Install feature strips where indicated.

J. Do not mix manufacturing batches of a color within the same area.

K. Do not install resilient flooring over building expansion joints.

L. Do not install defective or damaged resilient flooring.

M. Layout resilient flooring to provide equal size at perimeter. Adjust layout as necessary to reduce the amount of resilient flooring which is cut to less than half full width.

N. Install resilient flooring without voids at seams. Lay seams together without stress.

O. Remove excess adhesive immediately

3.4 INSTALLATION TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Install square tile to pattern shown on drawings. Allow minimum 1/2 full size tile width at room or area perimeter.

C. Install plank tile with a random offset of at least 6 inches from adjacent rows.

D. QHT- 4 & 5; Use welded rodjoints.

E. Lay out tiles to match existing.

F. Roll the plank or tile with a 3-section 100 lb. roller. Re-roll the floor within the working time of the adhesive. Continue to roll the floor throughout the working day to ensure a proper bond.

3.5 INSTALLATION RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.6 INSTALATION - STAIR COVERING

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

C. Perform initial maintenance procedures in accordance with manufacturer's requirements.

3.7 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

C. Full maintenance instructions shall be provided by the manufacturer

3.8 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation and 72 hours heavy rolling loads.

B. Use floor protection after installation. DO NOT use a plastic adhesive-based protection system.

3.9 SCHEDULE

A. Refer to Finish Schedule on drawings.

SECTION 09 6723
RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. High-performance resinous flooring systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.

C. Material Certificates: For each resinous flooring component, from manufacturer.

D. Maintenance Data: For maintenance manuals.

E. Samples: Submit two 6” X 6” samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Owner in writing or approved by General Contractor prior to installation.

F. Product Schedule: For resinous flooring.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

1. Engage an installer who is approved in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

2. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

3. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.

4. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.

a. Apply full-thickness mockups on 16 square foot floor area selected by Construction Manager.

b. Simulate finished lighting conditions for Architect's review of mockups.

c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

d. Mockup shall demonstrate desired slip resistance for review and approval by Owner’s representative in writing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by:

1. Palma Inc. 628 NJ-10 Suites 2 & 3, Whippany, NJ 07981 800 336-7256

B. Product: Novalac 185 - Resilient colored quartz epoxy flooring.

1. Bodycoat: 3/16" (185 mil)

2. Colored quartz aggregate

3. Topcoats: Standard non-slip finish, 2 coats PalmaLite Novalac

2.2 HIGH-PERFORMANCE RESINOUS FLOORING

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.

B. System Characteristics:

1. Color and Pattern: As indicated on drawings.

2. Slip Resistance: Provide slip resistant finish.

3. Compressive Strength : 13,500 psi.

4. Water absorption : 0.37%

5. Bond strength: 535 psi.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.

B. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, mortar grout, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable, try a test patch.

C. Verify that concrete and quarry tile substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests indicated below.

a. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

3.2 ENVIRONMENTAL CONDITIONS

A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers’ installation instructions shall be implicitly instructions shall be implicitly followed.

B. Repair damaged and deteriorated concrete. Remove loose or damaged grout mortar joints at existing quarry tile floor. Perform remedial work in accordance with resinous flooring manufacturer's written instructions.

C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.3 APPLICATIONS

A. Install resinous floor over properly prepared existing concrete and quarry tile surfaces in strict accordance with the manufacturer's directions.

1. Trowel the bodycoat over thoroughly cleaned and prepared surfaces.

2. Broadcast colored quartz aggregate into wet bodycoat. Remove excess aggregate when dry.

3. Apply 2 coats PalmaLite Novalac.

4. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.

B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

C. Slip Resistant Finish: As provided by slip resistant Novalac PalmaLite product.

D. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.4 COMPLETED WORK

A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.

1. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

2. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. New and existing ferrous metal columns, angles and beams

2. Exposed surfaces of steel lintels and ledge angles.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

5. Glass.

6. Concealed pipes, ducts, and conduits.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 1200 - Structural Steel.

C. Section 05 5000 - Metal Fabrications: Shop-primed items.

D. Section 09 9123 - Interior Painting.

1.4 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.5 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. SSPC-SP 2 - Hand Tool Cleaning; 1982, with Editorial Revision (2004).

G. SSPC-SP 3 - Power Tool Cleaning; 1982, with Editorial Revision (2004).

H. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Fuller and D'Angelo, P.C. before preparing samples, to eliminate sheens not required.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five (5) years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three (3) years experience.

1.8 MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide column & beam assembly illustrating paint color, texture, and finish.

C. Locate where directed by Owner's Representative.

D. Mock-up may remain as part of the work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer.

B. Paints:

1. Base Manufacturer: Sherwin-Williams Company; www.sherwin-williams.com.

C. Substitutions: See Section 01 2500 - Substitution Procedures

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.

2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Colors: Black.

2.3 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated.

1. Top Coat(s): Exterior Urethane Alkyd;

a. Products:

Sherwin-Williams; Pro Industrial Urethane Alkyd Enamel. B54-150 Series

B. Ferrous Metals, Primed, Latex, 2 Coat:

1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.

2. Topcoat: Acrylic Latex applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.5 to 4.0

a. Sherwin Williams: Pro Industrial Acrylic.

C. Galvanized Metals, Alkyd, 3 Coat:

1. One coat galvanize primer.

2. Two coats of alkyd enamel:

a. Intermediate coat: Alkyd enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6.

a) Sherwin Williams Direct To

b. Finish coat: Alkyd enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6.

a) Sherwin Williams Direct To Metal Alkyd Enamel Semi-Gloss Pure White

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Water based wash Primer for Galvanized Metal; and aluminum.

a. Products:

a) Sherwin Williams; DTM Wash Primer, B71Y00001.

b) Substitutions: See Section 01 2500 - Substitution Procedures

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

2. Prepare surface according to SSPC-SP 2.

G. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3. Remove rust, loose mill scale, and other foreign substances by power wire brushing, power sanding, power grinding, power tool chipping and power tool descaling, using methods recommended in writing by paint manufacturer and SSPC-SP 3. Protect from corrosion until coated.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish new interior surfaces exposed to view, or any existing surfaces affected by construction operations unless fully factory-finished and unless otherwise indicated.

1. Steel door frames
2. Concrete masonry units (CMU).
3. Gypsum Board/Plaster walls, soffits, and ceilings.
4. Metal trim and specialty items
5. Exposed surfaces of steel lintels
6. Mechanical and Electrical:
    a. In finished areas , paint conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    b. In finished areas, paint shop-primed items.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
6. Ceramic and other tiles.
7. Acoustical materials, unless specifically indicated.

8. Concealed pipes, ducts, and conduits.

1.3 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 5000 - Metal Fabrications: Shop-primed items.

C. Section 08 1113 - Hollow Metal Doors and Frames.

D. Section 09 2116 - Gypsum Board Assemblies.

1.4 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.5 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2017).

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 2 - Hand Tool Cleaning; 1982, with Editorial Revision (2004).

F. SSPC-SP 3 - Power Tool Cleaning; 1982, with Editorial Revision (2004).

G. SSPC-SP 13 - Surface Preparation of Concrete; 1997 (Reaffirmed 2003).

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").

2. MPI product number (e.g., MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Fuller and D'Angelo, P.C. before preparing samples, to eliminate sheens definitely not required.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Construction Manager's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 3 gallons of each color; from the same product run, store where directed.

3. Label each container with color and type in addition to the manufacturer's label.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 10 years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience.

1.8 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 4 feet long by 4 feet wide, illustrating paint color, texture, and finish.

C. Provide door and frame assembly illustrating paint color, texture, and finish.

D. Locate Where directed by the Construction Manager.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. Substitutions: Refer to Section 01 2500 - Substitution Procedures..

B. Paints:

1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.

2. Primer Sealers: Same manufacturer as top coats.

C. Substitutions: 01 2500 - Substitution Procedures..

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Fuller and D'Angelo, P.C. from the manufacturer's full line.

E. Colors: As indicated in Finish Schedule.

1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

A. Concrete/Masonry, Opaque, Latex, Three coats: (New surfaces)

1. Block Filler: One Coat Spreading rate recommended by manufacturer to achieve a dry film thickness of 16 mils wet; 7.7 mils dry

a. Sherwin Williams Super PrepRite Block FillerCraft No. 285.

2. Topcoat:Two Coats latex enamel spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 mils dry.

a. Sherwin Williams ProMar 400 Zero VOC Egg Shell

B. Concrete/Masonry, Opaque, Latex, 2 coat: (Existing surfaces)

1. Latex Primer Sealer: One Coat latex enamel spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 mils dry..

a. Sherwin Williams Multi-Purpose Interior Exterior Latex Primer EW

2. Topcoat: Semi-gloss: One coat of latex enamel.

a. Sherwin Williams ProMar 400 Zero VOC Egg Shell

C. Ferrous metals, Not Primed, Acrylic Latex, 3 coat:

1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.6 mils.

a. Sherwin Williams Direct-to-Metal Semi-Gloss.

2. Topcoat: Two coats Acrylic Latex

a. Sherwin Williams ProMar 200 Zero VOC Semi-Gloss

D. Ferrous metals, Primed, Acrylic Latex, 2 coat:

1. Touch up with latex primer.

2. Two Coats Acrylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils:

a. Sherwin Williams ProMar 200 Zero VOC Semi-Gloss

E. Aluminum and Galvanized Metals, Not Primed, Acrylic Latex, 3 coat:

1. One Coat latex primer spreading rate recommended by manufacturer to achieve a film thickness of 5.0 to 10 mils wet; 1.8.to 3.6 mils dry..

    a. Sherwin Williams Pro-Cryl Universal Primer

2. Two Coats Acrylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils:

    a. Sherwin Williams ProMar 200 Zero VOC Semi-Gloss

F. Gypsum Board/Plaster, Latex, 3 coat: (New Surfaces)

1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet and 1.3 mils dry.

    a. Sherwin Williams QUICK DRY Interior Exterior Stain Blocking Primer Latex

2. Topcoat: Two Coats of Acrylic Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils

    a. Sherwin Williams ProMar 200 Zero VOC Egg Shell

G. Gypsum Board/Plaster, Latex, 2 coat: (Existing Surfaces)

1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet and 1.1 mils dry..

    a. Sherwin Williams QUICK DRY Interior Exterior Stain Blocking Primer Latex

2. Topcoat: One Coat of Latex spreading rate recommended by manufacturer to achieve a dry film thickness of 4 mils wet; 1.3 nils dry to 5.6 mils

    a. Sherwin Williams ProMar 200 Zero VOC Egg Shell

H. Concrete Floor Surface, Urethane modified alkyd resin, Two coat (Existing surfaces)

1. One Coat latex primer spreading rate recommended by manufacturer to achieve a dry film thickness of 5-8 mils wet and 2.1-3.2 mils dry.

2. High Gloss: One coat Alkyd Enamel spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 4.0 mils.

    a. Sherwin Williams Pro Industrial Urethane Alkyd Enamel

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

B. Interior/Exterior Latex Block Filler; MPI #4.

1. Products:

    a. Sherwin-Williams ConFlex Block Filler. (MPI #4)

    b. Substitutions: See Section 01 6000 - Product Requirements

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Fuller and D'Angelo, P.C. of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.

2. Plaster and Stucco: 12 percent. (Existing)

3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

4. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

1. Prior to removing mildew, test any cleaner on a small, inconspicuous area prior to use.

2. Bleach and bleaching type cleaners may damage or discolor existing paint films. Alternative cleaning solutions may be required

3. Wear protective eye wear, waterproof gloves, and protective clothing.

F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Clean concrete according to ASTM D4258. Allow to dry.

3. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

2. Prepare surface as recommended by top coat manufacturer.

3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.

H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

L. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and SSPC-SP 3. Protect from corrosion until coated.

M. Cleaning Existing Walls: Remove all loose paint, plaster and other coatings.

1. Working from bottom to top, apply prepared cleaning solution to a dry surface.

2. Leave solution on the surface for 5-20 minutes. If solution begins to dry, reapply.

3. Gently scrub heavily soiled areas.

4. Rinse thoroughly with clean water with by masonry washing equipment generating 400-1000 psi with a water flow rate of 6-8 gallons per minute delivered through a 15-45 degree fan spray tip.

5. Apply after wash. Let the Afterwash stay on the surface for three to five minutes.

6. Pressure rinse from the bottom of the treated area to the top.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Sand metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

SECTION 10 1100
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

B. Tackboards.

1.3 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.4 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard and trim.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Submit color charts for selection of color and texture of markerboard and trim.

E. Manufacturer's printed installation instructions.

F. Maintenance Data: Include data on regular cleaning, stain removal .

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five (5) years documented experience.

1.7 WARRANTY

A. Porcelain Enamel Markerboard Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specified warranty period,

provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

1. Warranty Period: 50 years from date of Substantial Completion

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Claridge Products and Equipment, Inc: www.claridgeproducts.com.

B. Substitutions: Section 01 25 00 Substitution Procedures.

2.2 VISUAL DISPLAY UNITS

A. Fixed Markerboards: Porcelain enamel on steel, laminated to core.

1. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch .

2. Core: Particleboard, 1/2 inch thick, laminated to face sheet.

3. Backing: Aluminum foil, laminated to core.

4. Size: As indicated on drawings.

5. Frame: Extruded aluminum , with concealed fasteners.

6. Frame Profile: As indicated on drawings.

7. Frame Finish: Anodized, natural.

B. Accessories: Provide:

1. Manufacturer's standard, continuous, box-type, aluminum chalktray with slanted front and cast-aluminum end closures for each markerboard.

2. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:

a. Display Rail: Provide continuous cork display rail, 2 inches (25 or 50 mm) wide integral with map rail.

b. End Stops: Provide one end stop at each end of map rail.

c. Map Hooks: Provide 2 map hooks for every 48 inches of map rail or fraction thereof.

d. Flag Holder: Provide one flag holder for each room

C. Tackboards: Fabric laminated to cork.

1. Cork Thickness: 7/32 inch.

2. Fabric: Vinyl coated fabric.

3. Color: As selected from manufacturer's full range.

4. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.

5. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

6. Size: As indicated on drawings.

7. Frame: Same type and finish as for markerboard.

8. Frame Finish: Anodized, natural.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.2 PREPARATION

A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Install with top of marker tray at 34 inches above finished floor.

C. Secure units level and plumb.

D. Butt Joints: Install with tight hairline joints.

E. Install tackable wall panels in accordance with manufacturer's recommendations on specified substrates with concealed attachments.

1. Fabricate re-wrapped edges where partial panels about each other, or adjacent surfaces or trim.

3.4 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Provide new and replacement signage as indicated on drawings.

B. Room and Corridor Door signs.

C. Interior Directional and Informational signs.

D. Emergency evacuation maps. (Correct floor plans will be provided by Owner's Representative. (Contractor shall fabricate and install).

1.3 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 SUBMITTALS

A. See Section , for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.

2. Submit for approval by Owner's Representative and Fuller and D'Angelo, P.C. prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Store tape adhesive at normal room temperature.

1.7 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metal or polymer finishes beyond normal weathering.

b. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: 5 years years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PANEL SIGN

A. Manufacturers

1. Flat Signs:

a. Crown Signs, 4 Executive Plaza, Yonkers, NY 10701; (914) 375-2118.

2. Substitutions: Section 01 2500 Substitution Procedures.

B. Manufacturer’s standard monolithic tactile plaque constructed utilizing a thermoforming process, which provides a fully homogeneous plaque sign. The sign body, face, raised text and Braille are compression molded to form a single dimensional component that results in a sign surface that exhibits a toughness that resists scratching, cracking, gouging and graffiti.

1. Style: Identification: Photopolymer Signs with raised lettering is physically attached, not laminated to the face plate.

a. Sign to be satin Braille and pictograms raised. "Tipping" shall be provided where just the tips or the raised areas are finished providing an extra layer of protection to the sign and paint.

b. Provide VHB Tape, holes drilled/countersunk for mounting, radius corners, and back plates.

2. Material: Extruded Engineered PVC/Acrylic alloy with Integral background colors and high impact resistance with Class A Fire Rating.

3. Frame: Plastic:

a. Thickness: 1/4 inch (3mm) or as shown on drawings.

b. Edge Treatment:

a) Standard 0.5" Radiused Corners.

c. Color: Black

4. Lettering/ Tactile Characters/Symbols: Integral Raised 1/32 inch (1 mm) from sign plate face.

a. Helvetica Med

5. Lettering Style: Typeface as selected from the manufacturer’s standard typefaces, upper case letters as indicated on drawings and match existing building signage.

6. Braille: Grade 2 braille, placed as indicated on drawings

a. Integral raised, painted to match background.

7. Contrast: Letters, numbers and symbols shall contrast with background.

a. Provide colors as shown on drawings.

8. Colors: As shown on drawings.

9. Color of Background: As selected from manufacturer’s standard background colors to match existing.

10. Color of Text and Raised Characters: As selected from standard colors to match existing.

11. Surface Texture: Matte

2.2 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

1. Plastic (self-extinguishing material) engraving stock with face and core piles in contrasting colors, in finishes and color combinations indicated or, if not indicated, as selected from the manufacturer's standard.

2.3 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

1. Flame Spread: Less than 25.

2. Smoke Development: Less than 450

B. Provide for locations and rooms as scheduled and shown on drawing. **In addition to those indicated on drawings**:

1. Five (5) type 'A' signs;

2. Six (6) type 'B' signs

3. Six (6) type 'G' signs.

C. Emergency Evacuation Maps:

1. Plan plans will be provided by the Owner's Representative.

2. Fabricate and install as indicated on drawings.

3. Second surface direct print on non-glare clear acrylic, back painted.

4. Location: Where shown on drawings.

5. All for one map per classroom and occupied spaces.

2.4 ACCESSORIES

A. Concealed Screws: Security type Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. All signs to be mechanically fastened and taped.

C. Install neatly, with horizontal edges level.

D. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

SECTION 10 2601
WALL AND CORNER GUARDS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Corner guards.

1.3 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.4 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2018c.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.

C. Samples: Submit two sections of bumper rail, 24 inch long, illustrating component design, configuration, color and finish.

D. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project

B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.

C. Code compliance: Assemblies should conform to all applicable codes including New York State Building Code

D. Fire performance characteristics: Provide wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class 1 characteristics listed below:

1. Flame spread: 25 or less.

2. Smoke developed: 450 or less.

E. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.

F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D-1308

G. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.7 DELIVERY, STORAGE AND HANDLING

A. Materials must be acclimated in an environment of 65°-75°F (18°-24°C) for at least 24 hours prior to beginning the installation.

B. Installation areas must be enclosed and weatherproofed before installation commences

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wall and Corner Guards:

1. Construction Specialties, Inc: www.c-sgroup.com

a. SFS Series, - 20 RN

2. Substitutions: Section 01 2500 Substitution Procedures.

2.2 COMPONENTS

A. Corner Guards - Flush Mounted:

1. Material: High impact vinyl with full height extruded aluminum retainer.

2. Fire Resistance: Where fire rating is specified for the wall in which the guard is mounted, provide assemblies that have been tested in accordance with ASTM E119 for the same rating as the wall.

3. Width of Wings: 2 inches.

4. Corner: Radiused.

5. Color: As selected from manufacturer's full colors.

6. Length: One piece.

H. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

I. Fabrication: Weld, fill, and grind components smooth.

J. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

K. Finish of Cabinet Interior: White colored enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Cabinet Signage: "FIRE EXTINGUISHER".

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, as indicated on drawings from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets and on wall brackets.

3.3 SCHEDULES

A. Fire Extinguishers

1. Model MP10

a. Capacity: 10 lbs

b. Weight: 18 lbs

c. Cylinder Diameter: 5”

d. Height: 20”

e. Width: 7-3/4”

f. UL rating: 4A-80B: C

g. Standard Bracket: 5525

h. Location: in all areas except mechanical and electrical rooms.

2. Model DC10

    a. Capacity: 20 lbs.

    b. Weight: 38 lbs

    c. Cylinder Diameter: 7”

    d. Height: 23-1/4”

    e. Width: 7-3/4”

    f. UL rating: 2A-C

    g. Standard Bracket: 5525

    h. Location: Mechanical and electrical rooms.

3. Model DC-10

    a. Capacity: 10 lbs.

    b. Weight: 18 lbs

    c. Cylinder Diameter: 5”

    d. Height: 20”

    e. Width: 8.5”

    f. UL rating: 60B-C

    g. Standard Bracket: 5525

    h. Locations: Science rooms.

B. Fire Extinguisher Cabinets.

1. Larson's Cameo Series FS C2409-5R semi-recessed design suitable for fire extinguishers specified.

2. Trim: 5/16"

3. Acrylic Bubble.

4. Finish: Stainless Steel #4 satin finish.

5. Construction: High impact plastic.

RAYMOND/RAYMOND ASSOCIATES
SECTION 11 40 00 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section shall conform to the requirements of the Contract Documents including drawings and general provisions of the Contract, General and Supplementary Conditions and Division 01 Specification Sections.

1.2 BIDS

A. Unless otherwise noted, Kitchen Equipment Contractor (KEC) is a sub-contractor to the General Contractor (GC) and is to provide and install all items listed in this section and as detailed on food service drawings.

B. All Prime Contractors shall review the Food Service Drawings, FS.1 thru FS.9 and are responsible for all work items called out as being by their specific trade (ie: electrical, plumbing, mechanical, general, etc.) All kitchen equipment shall be provided and installation shall be part of the Prime Contract for General Construction (GC). Additionally, all references to the Kitchen Equipment Contractor (KEC) in the Food Service Drawings or Specifications is referencing work that is to be performed by a subcontractor to the Prime Contract for General Construction (GC). The Kitchen Equipment Installer will not be making final connections, all final connections of equipment shall be by the Prime Contracts under this project (MC, PC, EC). All Prime Contractors are responsible for coordination with one another and with the Kitchen Equipment Contractor under the GC Prime Contract.

C. Raymond/ Raymond Associates is herein identified as the Food Service Consultant.

D. Bids must be based on equipment of manufacturers specified; no substitution will be accepted after award of Contract.

E. Substitutions: When a product or material is specified by name and or model number, as noted in these specifications, such specifications establishes the standard type and quality considered most satisfactory for the particular purpose in the building. The bid proposal therefore should be based thereon, so that all bidders bid under the same conditions. Another product or material of the same type that meets the requirements may be submitted for consideration as a substitute only under the following conditions:

1. In providing substitution requests, the bidder must prove equivalence of the substitution and furnish detailed specifications and catalog cuts or drawings. Failure to identify exceptions or deviations from equipment specified must be interpreted to indicate that the product offered complies with the specification in every respect.

F. Custom fabrication, millwork, equipment, etc. must be built by a company continually in business for at least a 5-year period.

G. Contract documents convey a method of construction for custom fabrication; however this may or may not be the appropriate method based on selected fabricators industry knowledge and standards. It will be the responsibility of the selected fabricator to interpret and apply appropriate methods of construction for full functionality of custom fabrication.

1.3 WORK INCLUDED

A. KEC shall coordinate with other trades or sub-contractors in order that whole installation may result in the highest grade possible.

B. KEC shall provide and install only such valves, traps, faucets, shut-offs, reducing pressure valves, relief valves and other specialty items required within equipment and as hereinafter specified.

C. KEC shall make all necessary cut-outs and knock-outs where required on equipment to accommodate electrical receptacles, switches or other electrical outlets and equipment, together with such cut-outs as required for passage of gas or plumbing piping, etc.

D. KEC shall stack and remove rubbish waste material, crating, etc., resulting from work and keep the premises clean at all times. Upon completion of the installation, thoroughly and finally clean all equipment ready for use.

1.4 POWER AVAILABLE

A. Electric Voltage: 120/208/480 volt, 60 cycle, 1 & 3 ph.

B. Water Pressure: Typical Food Service Equipment range 25 to 90 PSI, if required, pressure reducing valves provided by Plumbing Contractor.

C. Water Temperature(s):

1. 110°-120° Fahrenheit max at hand washing sinks, work sinks and preparation sinks.
2. 120°-140° Fahrenheit max at 3-compartment pot sink, dishwashers and hose reel assembly.
3. 110°-120° Fahrenheit max at cooking equipment with faucet assembly.

1.5 GENERAL CHARACTERISTICS OF EQUIPMENT

A. Electrically Operated

1. Electrically operated equipment to be listed by Underwriters Labs., Inc.
2. Motors: Up to and including 3/4 horsepower, shall be 120/60/1.
3. Motors: Over 3/4 horsepower, 208/60/3, unless otherwise indicated.
4. Ranges, food warmers, etc., over 2.0 kW, 208/60/1 or 208/60/3, unless otherwise indicated.
5. Electrically heated equipment, etc., 2.0 kW and under, 120/60/1.
6. 1 ph. electrical plug-in units with 3 wire cords; 3 wire cap.
7. 3 ph. electrical plug-in units with 4 wire cords; 4 wire cap.
8. Motor driven equipment: equipped with starting switch.
9. Motors: equipped with overload protection.
10. Wiring on fixtures, including operating switches and pilots, furnished by Kitchen Equipment Contractor.

B. Submit in writing to Architect and Food Service Consultant for approval, schedule showing proposed electrical characteristics of each piece of equipment and disconnect means provided.

C. Punch holes for, and install hood and walk-in cooler/freezer lights and concealed conduits. The interconnection of same, including control switch, wiring, inter-wiring between sections, etc., by Electrical Contractor.

1.6 WORK EXCLUDED FROM THIS DIVISION

A. The following work is to be performed by other trades or sub-contractors and is not the responsibility of the Kitchen Equipment Contractor. The GC is responsible to hire all necessary sub-contractors.

1. Electrical Contractor
   a. Make connections to all food service equipment as shown.
   b. Furnish disconnect switches.
   c. Interconnecting of all exhaust hood lights, switches, control packages, interfaces, etc. including inter-wiring between sections of exhaust hoods.
   d. Interconnecting of control switches as required on equipment shown, and all other components which come as part of any equipment shown on plan.
   e. Interconnecting of any equipment, including, but not limited to, walk-in coolers/ freezers monitoring, exhaust hood monitoring and/ or fire protection monitoring with building management systems.
   f. Review all manufacturer approved installation methods/ diagrams and comply for proper installation of equipment being furnished.
2. Plumbing Contractor
   a. Make hot and cold water, waste and gas connections to all kitchen equipment shown, furnishing all necessary shut-offs, traps, backflow preventers, vacuum breakers, grease traps, drain line runs, etc.
   b. Install all faucets, pot fillers, filters and pressure regulators as furnished by Kitchen Equipment Contractor.
   c. Interconnecting of any and all other components that come as part of any other equipment shown.

d. Provide floor drains and floor sinks where shown and indirect piping to floor drains and floor sinks as indicated on drawings.
e. Review all manufacturer approved installation methods/ diagrams and comply for proper installation of equipment being furnished.

3. Ventilation Contractor
   a. Furnish size, shape and location of vent collars for exhaust hood and make connections to these collars.
4. General Contractor
   a. Provide and/or coordinate all work to the floors, walls and ceilings of the space.
   b. Provide wall blocking where required and as indicated on food service drawings.

1.7 SUB-CONTRACTORS TO KITCHEN EQUIPMENT CONTRACTOR

A. Fire Protection Contractor for the wet chemical protection system within exhaust hood systems only and Refrigeration Contractor for the remote refrigeration packages for walk-in coolers/ freezers, rack systems, etc. are typical sub-contractors to the Kitchen Equipment Contractor.

B. KEC to provide the name and addresses of all sub-contractors furnished to Architect/Owner and Food Service Consultant at time of submitting shop drawings. Selection of sub-contractors must be approved by them; and if in their judgment any fail to prosecute work in strict accordance with drawings and contract, after due notice from Owner or his agent, shall discharge same, but this in no way releases Kitchen Equipment Contractor from his obligations and responsibility under the contract.

C. Every sub-contractor bound by terms and provisions of the contract so far as applicable to his work. Nothing contained herein shall create any contractual relations between any sub-contractor and Owner.

D. Kitchen Equipment Contractor fully responsible to Owner for acts and omissions of his/ her sub-contractors.

1.8 SHOP DRAWINGS, ETC.

A. Immediately upon award of Contract and within 4 weeks, submit to Architect/Owner and Food Service Consultant, drawings for approval. Submit 1/4" scale rough-in drawings showing locations of plumbing and electrical connections with all requirements indicated at point of connection; use of a legend or numbered connection plan will be cause for drawing rejection. Prior to fabrication, submit to Architect for approval 1/2" scale shop drawings showing plan, elevations and isometric views covering all items of work. Drawings to show dimensions and details of construction, installation and relations to adjoining and related work where same requires cutting or close fitting. Show reinforcement, anchorage, etc., required for complete installation. After correction and approval of above, submit sets for record, then afterwards as many additional copies as required by client.

B. Submit in same manner as above, drawings showing masonry bases, depressed floors, positions of walls, requirements for ceiling hangers, wall blocking, and any other special conditions necessary for complete and correct correlation of various trades for satisfactory installation of all equipment shown on drawings.

C. Manufacturer's names, cuts, descriptive data, analysis of tests, rated capacities and other information necessary for approval of standard manufactured articles and equipment furnished to Architect/Owner and Food Service Consultant for approval before ordering or purchasing. This submission made in same manner as above. All cuts marked with item number, mechanical characteristics, accessories furnished and bound in folders.

1.9 GENERAL

A. No machine or equipment acceptable from any manufacturer not having had equipment of approximately the same type and design as that specified operating successfully for at least 5 years. Machines installed for test purposes shall not come within the category of successful commercial operation.

B. Architect/Owner and/or Food Service Consultant privileged to inspect material and fabrication at Kitchen Equipment Contractor's or its sub-contractors factory at any time.

C. Before proceeding with shop work, Kitchen Equipment Contractor to verify all measurements at premises. Where required dimensions are not immediately obtainable and delay in waiting for these dimensions would cause work to

be seriously delayed, the matter shall be referred to Architect for a decision. In obtaining measurements, Kitchen Equipment Contractor shall consider work requirements of other trades and equipment designed and fabricated to provide necessary clearance for surrounding and adjoining work.

D. Kitchen Equipment Contractor responsible for making any and all necessary adjustments to complete his work in a workmanlike manner, as approved by Architect/Owner.

E. Dimensions as indicated on drawings and specifications are approximate, and are to be adjusted if and where necessary to suit job conditions and field measurements.

F. Tops of tables, shelves, tops and exterior panels of cabinets, counters, doors, drainboards, etc., to be constructed of a single sheet of metal. Where size of equipment requires more than 1 sheet of metal, sheets butt joined with joints continuously welded full length. No joints less than 18" from an edge or end of a piece of equipment. In addition, all joints shall have battens or stiffeners welded to jointed material, ground smooth and polished.

G. Appliances of rigid construction free from objectionable vibration and quiet in operation.

H. Electrical heating elements shall conform to latest standards of National Electrical Manufacturer's Association and Underwriters Labs., Inc., where applicable standards have been set up by such agencies.

I. Motors of ample power to operate machines for which designated under full load operating conditions without exceeding nameplate ratings. Horsepower requirements on driven equipment determined by manufacturer, based on normal operation of maximum capacity.

J. Motors drip-proof, splash-proof or totally enclosed type, having two-hour duty cycle and ball bearings (except small timing motors which may have sleeve bearings). All motors shall have windings impregnated to resist moisture. Motors located where adjacent to deposits of dust, lint, etc., totally enclosed type.

K. It is the responsibility of the Kitchen Equipment Contractor to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide stainless steel cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections within table/counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated.

1.10 STAINLESS STEEL (S.S.)

A. Where S.S. is specified, it shall be Type 304, nickel bearing iron alloy, containing approximately 17.0% to 19% chromium, 8% to 10% nickel, not more than 0.2% carbon, and not more than 2.0% of other alloying elements; designed being austenitic (non-magnetic).

B. S.S. free from scale with all surfaces polished to a high commercial finish. All welding and exposed welds hereinafter specified, must be ground down and polished smooth to a #4 finish so that no evidence of welding will appear. Unexposed welds on underside of counter or tables ground smooth and treated with an acid solution to remove weld discoloration and oxidization and to arrest corrosion.

C. Undersides of all counters, work tables, sinks, drain boards, etc., after fabrication, to have one (1) heavy coat of sound deadening material applied as allowed by local codes.

D. Gauges for sheet iron and sheet metal, U.S. Standard.

E. Rivets, welds, bolts, screws, nuts and washers to be steel except where brass or S.S. is fastened, in which case they shall be brass or S.S., respectively. Where dissimilar metals are fastened, welds, bolts, rivets, screws, nuts and washers, highest grade metal. Spacing and extent of welds, rivets, bolts and screws such as to insure suitable fastening and prevent bulging of metals fastened.

1.11 SANITATION

A. All custom built equipment constructed in accordance with standard No. 2, 4 & 7 of National Sanitation Foundation Testing Laboratory, manufactured by a company approved by N.S.F. and carry their stamp of approval. Kitchen Equipment Contractor must have "Registered" numbered seal of N.S.F. approval.

1.12 OPERATING INSTRUCTIONS

A. Kitchen Equipment Contractor shall leave all items of equipment in good, operating condition and furnish the services of a "qualified" competent manufacturer's representative to instruct Owner's employees in proper use and care of equipment. Representative on call for as long a period as is necessary to assure Owner that such instruction is thoroughly understood.

B. Kitchen Equipment Contractor shall be responsible for scheduling of equipment demonstrations and/or training and shall provide a detailed list of expected dates, times and manufacturer’s representative to be present (in attendance) for each piece of equipment.

C. Kitchen Equipment Contractor or his qualified manufacturer's representative, thereafter, shall make all necessary calls during warranty period.

1.13 SAMPLES

A. After Award of Contract, when requested, Kitchen Equipment Contractor shall supply Architect with samples of fabricated equipment, such as corner of table with a rolled or inverted "V" edge, corner of dish table, overshelf, drawer assembly, table leg with foot and gusset, or as specifically requested.

1.14 GUARANTEE

A. Kitchen Equipment Contractor shall guarantee, as part of the bid and/or contract, workmanship, material and equipment for a period of 2 years from date of equipment final install and project turnover to Owner, and shall remedy any defect due to faulty workmanship or materials which may appear within guarantee period.

B. Manufacturer's operation and maintenance manuals on equipment, etc., turned over to the Owner in duplicate, bound in a folder and marked accordingly.

1.15 EQUIPMENT CONSTRUCTION AND STANDARDS

A. Where initials S.S. are used, they refer to "stainless steel;" C.P. refers to "chrome plated;" N.I.C. refers to "not in contract;" G.I. refers to "galvanized iron;" F.D. refers to "floor drain", and F.S. refers to "floor sink."

1.16 WASTES AND OVERFLOWS

A. Sinks to have the following waste and overflow assemblies:

1. For 1-1/2” NPT: Fisher model 74043 or approved alternate. Lever handle waste outlet with overflow assembly, 3-1/2" sink opening, self-centering stainless steel face flange with flat strainer, 12 gpm max flow rate, stainless steel lever handle with ball, overflow head with stainless steel faceplate and chrome plated cast red brass drain body.
2. For 2” NPT: Fisher model 74043 or approved alternate. Lever handle waste outlet with overflow assembly, 3-1/2" sink opening, self-centering stainless steel face flange with flat strainer, 12 gpm max flow rate, stainless steel lever handle with ball, overflow head with stainless steel faceplate and chrome plated cast red brass drain body.

1.17 WATER INLET LOCATION

A. Located in all cases above the positive water level to prevent siphoning of liquid into water system. Wherever conditions require water inlet below such level, a suitable type of vacuum breaker shall be placed on fixture and form part of same to prevent such siphoning.

B. All faucets furnished by Kitchen Equipment Contractor as specified. Traps furnished by Plumbing Contractor.

1.18 PITCH AND DRAINAGE

A. Wherever a fixture is used with waste or drain outlet, surface shall have distinct pitch towards outlet. Drainboards and tables that contain or adjoin sinks shall have a definite pitch towards sinks. Where necessary, surfaces creased and grooved to give a definite pitch.

1.19 SINKS

A. #14 gauge S.S. interior corners rounded to 1" radius horizontally and vertically, forming a cove in bottom. All joints butt edged. Sink sizes given, inside measurements.

B. Bottom of each compartment creased to center and fitted with a rotary drain as described in section 1.16, hereinbefore specified. Waste lever not to protrude beyond body of sink. Sinks to have overflows installed by Kitchen Equipment Contractor.

C. Overflow to consist of 1-1/2" chrome plated brass strainer plate, fitted in back of each compartment at proper level directly connected to waste outlet with 1-1/2" chrome plated brass pipe.

D. Back of sink extended integrally approximately 12" above working level, back 2-1/4" on 45° angle towards rear and then flanged down 1" and punched to accommodate faucets.

E. Front and both ends, unless otherwise specified and shown, finished on top edge, 3" above working level, with 1-1/2" diameter, 180° welded integral roll. Exterior corners rounded to a 2-1/2" radius, all integrally welded.

F. Sinks and drainboards finished on front and back edges only and left with straight edge on ends, so that drainboards may be welded thereto, forming integral units with top edge of rolled rim curbing formed on one horizontal plane across front to unit though surfaces of drainboards pitched to sinks.

G. Multiple compartment sinks divided with double wall #14 gauge S.S. partitions, all corners rounded same as corners in sinks, continuously welded in place.

H. Back, bottom and front of one continuous piece with no overlapping joints or open spaces between compartments.

1.20 SINK BOWL BUILT INTO TABLE TOP

A. Sink constructed integral with table top #14 gauge S.S. having all interior corners coved vertically and horizontally forming a cove in bottom. To have overflow, lever waste outlet, etc…, as hereinbefore specified for sinks in spec section 1.19.

B. All joints butt edged and welded, ground and polished, so that no evidence of welding will appear. All sink sizes inside measurements. Table top where shown, punched to receive deck type combination faucets, provided by Kitchen Equipment Contractor.

1.21 FAUCET AND BASKET DRAIN ASSEMBLY

A. Sinks to have the following faucet assemblies:

1. 3-Compartment Sink, Potwash:
   a. 1 ea. Fisher model 74306 or approved alternate. Pre-Rinse assembly with 1.3 gpm flow rate or less, splash/ wall mount, 8" centers, add-on faucet 12" stainless steel tubular swing spout with 4" wrist blade handles, 36" flexible gooseneck hose with spray head, stainless steel spring with wall bracket, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Deck mount assembly model 75485.
   b. 1 ea. Fisher model 60798 or approved alternate. Faucet with 2.2 gpm flow rate or less, splash/ wall mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Deck mount assembly model 57665.
2. 2-Compartment Sink, Preparation:
   a. 1 ea. Fisher model 57665 or approved alternate. Faucet with 2.2 gpm flow rate or less, deck mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2"

NPT female inlets, ADA compliant, NO LEAD and NSF approved. Splash/ wall mount assembly model 60798.

3. Work Sink (Built-in, Welded-In):
   a. 1 ea. Fisher model 57665 or approved alternate. Faucet with 2.2 gpm flow rate or less, deck mount with 4" wrist blade handles, 8" centers, 12" stainless steel tubular swing spout, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Splash/ wall mount assembly model 60798.
4. Hand Sink:
   a. 1 ea. Fisher model 58696 or approved alternate. Faucet with 2.2 gpm flow rate or less, deck mount with 4" wrist blade handles, 4" centers, 6" stainless steel swivel gooseneck spout, compression valves, 1/2" NPT female inlets, ADA compliant, NO LEAD and NSF approved. Splash/ wall mount assembly model 62650.

B. All plumbing fixtures shall be certified CSA, ASME A112.18.1/CSA B125.1, AB1953/HSC 116875, Vermont Bill S152, NSF/ANSI 61 sec 9, annex F and G, NSF/ANSI 372 low lead content, ASTM F2324.

1.22 DRAINBOARDS

A. #14 gauge S.S. full width of sink carried up approximately 12" at back and where adjacent to wall and finished same as heretofore described for back of sink, and having 3" high curbing at front and ends not adjacent to walls and finished with integral 1-1/2" diameter 180° roll, unless otherwise specified.

B. Drainboards continuously welded to sinks.

C. Drainboards 30" long or less shall have 1-1/2" #16 gauge S.S. tubular braces secured at underside near front and welded to S.S. gusset at leg anchor. All others to have legs and cross bracing with full length and width undershelf as specified for tables.

1.23 TABLES WITH S.S. TOPS

A. Tops of #14 gauge S.S. 1 piece construction with all edges turned down into 2" integral 180° roll with all corners rounded to 2" radius forming a bullnosed corner. Corner welded and polished smooth.

B. Table tops thoroughly cross braced with 4" x 1" S.S. channel stiffeners #14 gauge welded to underside. All cross braces spaced not over 24" on center.

C. Table tops adjoining walls or adjacent equipment carried up approximately 6" and returned 1", down 1" at top and ends. Intersections of table top and raised edge coved to 1" radius. Where backsplash is exposed, it shall have finished S.S. back.

D. It is the responsibility of the K.E.C. to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide S.S. cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections within table/counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated, if required.

1.24 NOT USED

1.25 NOT USED

1.26 NOT USED

1.27 NOT USED

1.28 NOT USED

1.29 NOT USED

1.30 NOT USED

1.31 NOT USED

1.32 NOT USED

1.33 NOT USED

1.34 NOT USED

1.35 NOT USED

1.36 NOT USED

1.37 NOT USED

1.38 NOT USED

1.39 SERVING COUNTER

A. Of size and shape as shown. Top of #14 gauge polished S.S. rolled down in a 2" diameter 180° roll on all exposed edges with corners bullnosed, welded. Top secured to counter base by means of concealed S.S. studs, nuts and washers. Angle frame under top sheathed with sound deadening material.

B. Base constructed with interior framing of 1-1/2" x 1 1/2" x 1/8" galvanized steel angle with all joints welded.

C. Angle framework concealed on the interior with #18 gauge polished S.S. sheathing. Exterior facing of base cabinet and ends to have sheathing of Plastic Laminate paneling laminated to 3/4" thick solid core, exterior grade marine plywood, panel length not to exceed 36". Color and style of paneling selected by Architect. Each panel of length as indicated, full height of counter and splined hairline joints. Panels and trim secured to interior framing by means of concealed welded studs, nuts and washers. Or constructed of alternate materials as detailed on drawings.

D. Interior of all available space provided with bottom and intermediate shelf of #16 gauge S.S. turned up approximately 2" at rear and ends, and down 1-1/2", and in 1/2" channel shape at front.

E. Mounted on masonry base, height as indicated on drawings or 6" high 14 gauge S.S. legs with S.S. removable toe base, where indicated. All openings in top flanged downward approximately 1" around their entire perimeter. Top cut out for and provided with equipment as hereafter specified.

F. It is the responsibility of the K.E.C. to supply and mount all electrical outlets, switches, controls, etc. within table/counter back splashes, aprons, panels, etc. and to provide S.S. cover plates as required. Furthermore, it is the responsibility of the Electrical Contractor, in coordination with the Kitchen Equipment Contractor, to make final interconnections within serving counter interior to junction boxes, outlets, switches, controls, etc. for equipment indicated, if required.

1.40 NOT USED

1.41 HOT FOOD SECTION

A. Top #14 gauge polished S.S. integral and continuous with counter and top, provided with 12" x 20" openings as shown.

B. Each opening to have #14 gauge S.S. well measuring approximately 6-1/2" deep. Where top is flanged down into well, fitted with a breaker strip on 4 sides of opening. When and where food wells are used with drains, all drains are to be interpiped with 1-1/2" C.P. or S.S. piping by Kitchen Equipment Contractor, and extended to common point near floor drain for Plumbing Contractor to make indirect waste connections. Kitchen Equipment Contractor to furnish and install C.P. or S.S. shut-off valve extending for easy access.

C. Each well heated as hereinafter specified, dry-moist type electric heater with individual thermostatic control and pilot light. Thermostat dials and pilot lights attached on attendant's side recessed into a panel installed inside of plate shelf areas or apron mounted as shown. All electric food wells connected to a common heavy toggle switch. Wiring concealed.

D. Food wells to have bottom of housing fitted with sectional removable #16 gauge G.I. bottoms for access to wiring and elements. Counter base under hot food section to be lined with #18 gauge S.S.

E. Each hot food section provided with the following #20 gauge Polar Ware Classic Anti-Jam inserts and covers: two S12104 pans with two 1/2 size lift-off covers and provide one dome-type 12" x 20" lift-off cover for each opening; two S12106 pans, three S12066 pans, four S20124 pans; four S12102 pans, four S20122 pans.

1.42 COLD PAN

A. Of size and shape shown, approximately 20" wide, of length as shown on plan, 6" deep in the clear, unless otherwise indicated, constructed in accordance with NSF #7, integrally constructed into counter and top. To have sectional #18 gauge S.S. perforated false bottom in sections not over 18" wide, 1/2" channel edge on 4 sides. Interior lining to have all corners rounded to 1" radius vertically and horizontally, of #14 gauge S.S. all joints and crevices welded. Where cold pan is used as a salad bar, same to be 8" deep in the clear unless otherwise indicated.

B. Insulation in all 4 sides and bottom of unit 2" thick polyurethane or equal. Refrigeration coils copper 1/2" O.D. and 3" on center, sweated to underside and embedded in insulation. Provide a copper tubular refrigeration coil, further sealed with hydrolene. Coils connected to compressor hereinafter specified, and shall have liquid line with solenoid valve and thermostat for control, provide a shut-off valve in liquid line ready and accessible to disengage same when required.

C. Exterior sheathing of #18 gauge S.S. bottom pitched and fitted with a 1-1/2" drain outlet with threaded connection plumbing. Plumbing Contractor to extend drain line so as to flow into adjacent floor drain. Joint between top of cold pan and turned down edge of counter top provided with breaker strip around full perimeter of opening.

D. Where shown, space under counter provided for installation of compressor. This section fitted with removable #18 gauge S.S. grill on attendant's side. Shall have not less than 75% rectangular perforation. Counter front panel and/or sides where possible in way of compressor housing louvered. Interior of housing reinforced with horizontal and vertical framework of 1 1/2" x 1-1/2" x 1/8" angle having all joints welded. Lower frame provided with #14 gauge channel stiffeners welded in place and fitted with rubber cushions. Channel spaced to properly support condensing unit. Housing approximately 24" left to right to properly admit compressors.

E. Refrigeration coils connected to condensing unit, size as indicated on plan, air cooled, furnished complete with all necessary copper tubing, thermostatic control valves dehydrators, expansion valves, sight glass, etc., to make a complete working unit with warranty and free service, guarantee for 1 year. Compressor connected to coils of cold pan in a satisfactory and operating manner. Compressor, etc., internally wired. Provide push button switch with pilot lite recessed in adjacent section in apron above housing to turn on/off cold pan as required.

1.43 NOT USED

1.44 TRAY SLIDE

A. Of size and shape, as hereinafter specified and/or shown on contract drawings. Installed where shown, 12" wide, #14 gauge S.S. construction or in strict accordance to that as detailed on drawings.

B. In general, unit mounted on #12 gauge S.S. ornamental type brackets secured to front trim of counter in a concealed manner with welded concealed studs. Back edge of turned up section made to fit tight with turned down front section of counter top and definitely free of voids, cracks and unsanitary joints.

1.45 NOT USED

1.46 COUNTER AND CABINETS WITH SLIDING DOORS

A. Tops #14 gauge polished S.S. with outer edges turned down vertically and integrally 2" then in 1-1/2" forming a channel edge on both exposed sides. Where adjacent to wall, top carried up approximately 6" or "as specified" and returned 1" at top and ends toward wall as hereinbefore specified for tables against walls, corners welded forming continuous unit. Tops fastened to cabinets by welded and concealed studs.

B. Cabinets below tops constructed of #18 gauge polished S.S. with all joints and crevices welded. Tops of cabinets reinforced with a horizontal frame of 1-1/2" x 1-1/2" x 1/8" angle with cross braces on 18" centers. Framework of all welded construction. Bottom and intermediate shelves constructed of #16 gauge S.S. with 4" x 1" #16 gauge S.S. channel stiffeners not over 24" on center.

C. Unit, unless otherwise specified and shown, mounted on 6" #14 gauge S.S. legs with adjustable bullet feet.

1.47 NOT USED

1.48 NOT USED

1.49 DOORS

A. Whether sliding or hinged type, not less than 1/2" thick overall, double paneled having 3/8" sound-deadening material between #16 gauge S.S. front and #18 gauge S.S. back, reinforced between panels by wide channels, running height of door and made of same material. Panels jointed with continuous welding. Doors and vent openings to have back panel boxed around vent opening and welded to front panel. Doors dust proof and entire front face without seams or joints.

B. Sliding doors mounted on ball bearing type rollers, sliding in dust proof #14 gauge S.S. tracks overhead, fastened so as to eliminate vibration and jarring when doors are rolled. Doors fitted with limit stops. Bottom guide of #14 gauge S.S. for doors, open and flat, lining up with lower shelf of cabinet - slots so arranged that crumbs or dirt accumulating in the cabinet will drop to the floor when cabinet is cleaned. Recessed handles solid material, not stamped, of S.S. welded to front panel. Finger grips of ample depth to comfortably pull the door. Doors provided with keyed-alike S.S. faced cylinder locks, built-in flush.

C. Hinged type doors flush fitting, unless otherwise specified, resting tightly against rabbetted frame. Hinged doors provided with Klein Model #Y-48 (or approved equal) keyed-alike S.S. faced cylinder locks with Model #12230-SM (or approved equal) handles. In case of pair of doors, each individually controlled as outlined and is to close against rubber bumpers.

D. Outer edges smooth, free from burrs, projections and fins. Excess welded metal removed by precision grinding and polishing.

1.50 REFRIGERATORS AND REFRIGERATION UNITS

A. Reach-in refrigerators, freezers, and refrigerated units, as shown unless otherwise specified, furnished by Kitchen Equipment Contractor They shall meet all requirements as set forth for individual item number and complete with self-contained or remote compressors and motors. Cooling coils blower type, unless otherwise called for, provided with initial charge of approved CFC free refrigerant. Plumbing Contractor responsible for extending refrigerator drain line, where required, to spill into adjacent floor drain in approved manner. Extended drain line not less than 3/4" I.D. and C.P. or S.S. tubing.

B. All refrigerated equipment, refrigerators and freezers, whether walk-in or reach-in, started and adjusted to maintain required temperatures, charged with approved refrigerant as required.

C. All reach-in refrigerators, freezers, hot food warmers, etc., to have keyed-alike locks. Kitchen Equipment Contractor must request this at time of placing order to avoid correction at a later date at Kitchen Equipment Contractor's expense.

D. Kitchen Equipment Contractor to provide 1 year's free service for all types of refrigerators and refrigeration equipment. Service to include all compressors, unit coolers, controls, etc., to include adjustments and repairs, irrespective of cause, whether mechanical, operational or manufacturing at no additional cost to Owner. Additionally, five (5) year warranty provided on all compressors, parts only or replacement.

1.51 NOT USED

1.52 NOT USED

PART 2 - PRODUCTS

GREENVILLE ELEMENTARY SCHOOL

ITEM #1 HAND SINK, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model HSA-10-FDPS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- 1 ea. Electronic faucet, gooseneck
- 1 ea. Soap dispenser
- 1 ea. Towel dispenser
- 1 ea. Left and right splash guards
- Wall backing by General Contractor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #2 3-COMPARTMENT SINK – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model FN2060-3-18-14/3. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Top Material: Stainless Steel, 14 Gauge
- 3 ea. Built-in work sinks, 20" L x 20" W x 14" D
- 3 ea. Waste valve with lever, Fisher Mfg. model DrainKing
- 3 ea. Tail piece, Fisher Mfg. model 6129
- 3 ea. Waste overflow, Fisher Mfg.
- 1 ea. Stainless steel pre-rinse assembly with 12" swing spout add-on faucet and wrist action handles, 1/2" connections
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 1/2" connections
- Flanged feet bolted to floor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #3 STORAGE SYSTEM, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model WAL-STOR. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Mounting Height: 50" above finished floor
- 2 ea. Wall grid/mat, WM1848-E, stacked
- 1 ea. Wall uprights, vertical, PR45VU-E
- 2 ea. Shelf, 1448-E
- 2 ea. Shelf Brackets, PR14B-E
- 1 ea. Grid Shelf, 1436WGS-E
- 2 ea. Baskets, WB-E

- 12 ea. Utility Hooks, UH-E
- 1 ea. Epoxy coated finish, entire wall system
- Wall backing by General Contractor

Or as manufactured by Focus or Metro.

ITEM #4 STORAGE SHELVING, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Metro Model MQ2160G. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Shelving to be sized to fit
- 5 ea. 21" x 60" Shelves with removable, vented inserts
- 4 ea. 74" High uprights
- 1 ea. Tool free shelf adjustment
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Eagle Group/Metal Masters or Cambro.

ITEM #5 CABINET, MOBILE, WARM/ HOLD – QTY. AS PER PLAN & SCHEDULE

Cres Cor Model H-137-SUA-12D-SD. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Capacity: (12) 18" x 26" Pans or (24) 12" x 20" Pans
- Verify door hinging
- 1 ea. LED digital display
- 1 ea. High impact resistant side panels
- 1 ea. Push handle
- 1 ea. Perimeter bumper
- 1 ea. Cord wrap
- 2 ea. Lock hasp with slide bolt
- 1 ea. Energy Star® Certified
- Mounted on heavy duty modulus casters, front two with brakes

Or as manufactured by F.W.E. or Metro.

ITEM #6 CABINET, MOBILE, REFRIGERATED – QTY. AS PER PLAN & SCHEDULE

Cres Cor Model R-171-SUA-10E-SD. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Capacity: (10) 18" x 26" Pans or (20) 12" x 20" Pans
- Verify door hinging
- 1 ea. Self-contained refrigeration
- 1 ea. LED digital display
- 1 ea. High impact resistant side panels
- 1 ea. Push handle
- 1 ea. Perimeter bumper, 1405-164
- 1 ea. Cord wrap

- 1 ea. Lock hasp with slide bolt
- 1 ea. Energy Star® Certified
- Mounted on heavy duty modulus casters, front two with brakes

Or as manufactured by F.W.E. or Metro.

ITEM #7 WORK COUNTER W/ SINK – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Top Material: Stainless Steel, 14 Gauge
- 1 ea. Built-in work sink, 20" L x 16" W x 12" D
- 1 ea. S.S. Removable sink bowl cover
    - Stainless steel, 14 Gauge
    - Finger holes, lift-off
    - Flush inlay with work sink/top
    - Integral bracket, under counter, to hold when not in use
- 1 ea. Waste valve with lever
- 1 ea. Tail piece
- 1 ea. Waste overflow
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 1/2" connections
- Cabinet/Door to be flush frame design
- Stainless steel integrated handles, horizontal orientation
- Cylinder locks, keyed alike, as required
- Intermediate stainless steel solid shelves, adjustable
- Stainless steel legs, 6" adjustable

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #8 SPARE NUMBER

ITEM #9 MILK COOLER – QTY. AS PER PLAN & SCHEDULE

Beverage Air Model SM58HC-S. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- 1 ea. Self-contained refrigeration, cold wall
- 1 ea. Electronic control
- 1 ea. Three year parts warranty
- 1 ea. Three year labor warranty
- 1 ea. Energy Star® Certified
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigeration or True Mfg.

ITEM #10 COLD FOOD COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model 4-BCM. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. 8" Stainless steel cutting board, SCB
- 1 ea. Filler panels FLP, where counters meet
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

ITEM #11 FOOD PROTECTOR(S), ADJUSTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model CG. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Gearless adjustment brackets
- 1" Tubular stainless steel posts
- Extend 16" above counter top, overall height
- Anchored below to counter frame for rigidity
- Stainless steel sleeve post extends thru counter top
- 3/8" Tempered glass, horizontal/vertical surfaces

Or as manufactured by Premier or Versa-Gard.

ITEM #12 FLAT TOP COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model 2-ST. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. 8" Stainless steel cutting board, SCB
- 1 ea. Filler panels, FLP, where counters meet
- 1 ea. Open under storage with shelf, ROU
- 1 ea. Duplex receptacle mounted in apron, S.S. cover plates, DOUT
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

ITEM #13 HOT FOOD COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model HF-4. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/1, NEMA 6-30P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. Bottom accessible elements
- 1 ea. 8" Stainless steel cutting board, SCB
- 1 ea. Filler panels FLP, where counters meet
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

ITEM #14 FOOD PROTECTOR(S), ADJUSTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model CG. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Gearless adjustment brackets
- 1" Tubular stainless steel posts
- Extend 16" above counter top, overall height
- Anchored below to counter frame for rigidity
- Stainless steel sleeve post extends thru counter top
- 3/8" Tempered glass, horizontal/vertical surfaces

Or as manufactured by Premier or Versa-Gard.

ITEM #15 CASHIER COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model 2-CD. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. Stainless steel tubular foot rest, TFR
- 1 ea. Duplex receptacle mounted in panel, S.S. cover plates, DOUT
- 1 ea. Data/ network port outlet mounted in panel
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

SEELY PLACE ELEMENTARY SCHOOL

ITEM #1 HAND SINK, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model HSA-10-FDPS. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- 1 ea. Electronic faucet, gooseneck
- 1 ea. Soap dispenser
- 1 ea. Towel dispenser
- 1 ea. Left and right splash guards
- Wall backing by General Contractor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #2 3-COMPARTMENT SINK – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model FN2060-3-18-14/3. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Top Material: Stainless Steel, 14 Gauge
- 3 ea. Built-in work sinks, 20" L x 20" W x 14" D
- 3 ea. Waste valve with lever, Fisher Mfg. model DrainKing
- 3 ea. Tail piece, Fisher Mfg. model 6129
- 3 ea. Waste overflow, Fisher Mfg.
- 1 ea. Stainless steel pre-rinse assembly with 12" swing spout add-on faucet and wrist action handles, 1/2" connections
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 1/2" connections
- Flanged feet bolted to floor

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #3 STORAGE SYSTEM, WALL MNTD. – QTY. AS PER PLAN & SCHEDULE

Eagle Group/Metal Masters Model WAL-STOR. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Mounting Height: 50" above finished floor
- 2 ea. Wall grid/mat, WM1848-E, stacked
- 1 ea. Wall uprights, vertical, PR45VU-E
- 2 ea. Shelf, 1448-E
- 2 ea. Shelf Brackets, PR14B-E
- 1 ea. Grid Shelf, 1436WGS-E
- 2 ea. Baskets, WB-E
- 12 ea. Utility Hooks, UH-E
- 1 ea. Epoxy coated finish, entire wall system
- Wall backing by General Contractor

Or as manufactured by Focus or Metro.

ITEM #4 STORAGE SHELVING, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Metro Model MQ2160G. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Shelving to be sized to fit
- 5 ea. 21" x 60" Shelves with removable, vented inserts
- 4 ea. 74" High uprights
- 1 ea. Tool free shelf adjustment
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Eagle Group/Metal Masters or Cambro.

ITEM #5 CABINET, MOBILE, WARM/ HOLD – QTY. AS PER PLAN & SCHEDULE

Cres Cor Model H-137-SUA-12D-SD. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Capacity: (12) 18" x 26" Pans or (24) 12" x 20" Pans
- Verify door hinging
- 1 ea. LED digital display
- 1 ea. High impact resistant side panels
- 1 ea. Push handle
- 1 ea. Perimeter bumper
- 1 ea. Cord wrap
- 2 ea. Lock hasp with slide bolt
- 1 ea. Energy Star® Certified
- Mounted on heavy duty modulus casters, front two with brakes

Or as manufactured by F.W.E. or Metro.

ITEM #6 CABINET, MOBILE, REFRIGERATED – QTY. AS PER PLAN & SCHEDULE

Cres Cor Model R-171-SUA-10E-SD. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Capacity: (10) 18" x 26" Pans or (20) 12" x 20" Pans
- Verify door hinging
- 1 ea. Self-contained refrigeration
- 1 ea. LED digital display
- 1 ea. High impact resistant side panels
- 1 ea. Push handle
- 1 ea. Perimeter bumper, 1405-164
- 1 ea. Cord wrap
- 1 ea. Lock hasp with slide bolt
- 1 ea. Energy Star® Certified
- Mounted on heavy duty modulus casters, front two with brakes

Or as manufactured by F.W.E. or Metro.

ITEM #7 WORK COUNTER W/ SINK – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Counter Top Material: Stainless Steel, 14 Gauge
- 1 ea. Built-in work sink, 20" L x 16" W x 12" D
- 1 ea. S.S. Removable sink bowl cover
    - Stainless steel, 14 Gauge
    - Finger holes, lift-off
    - Flush inlay with work sink/top
    - Integral bracket, under counter, to hold when not in use
- 1 ea. Waste valve with lever
- 1 ea. Tail piece
- 1 ea. Waste overflow
- 1 ea. Stainless steel faucet with 12" swing spout and wrist action handles, 1/2" connections
- Cabinet/Door to be flush frame design
- Stainless steel integrated handles, horizontal orientation
- Cylinder locks, keyed alike, as required
- Intermediate stainless steel solid shelves, adjustable
- Stainless steel legs, 6" adjustable

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #8 HAND SINK, BUILT-IN – QTY. AS PER PLAN & SCHEDULE

EMI New Jersey Model Custom. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- 1 ea. Electronic faucet
- 1 ea. Built-in hand sink, 12" L x 10" W x 7" D, tapered
- 1 ea. Soap dispenser, Component Hardware Model KS10-1000
- 1 ea. Integral towel dispenser, C-fold
- 1 ea. Integral raised stainless steel splashes, perimeter
- 1 ea. Rear / off-set drain connection

Or as manufactured by Aero Mfg. or IMC/ Teddy.

ITEM #9 MILK COOLER – QTY. AS PER PLAN & SCHEDULE

Beverage Air Model SM58HC-S. Unit to be installed where shown on drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- 1 ea. Self-contained refrigeration, cold wall
- 1 ea. Electronic control
- 1 ea. Three year parts warranty
- 1 ea. Three year labor warranty
- 1 ea. Energy Star® Certified

- Mounted on heavy duty casters, front two with brakes

Or as manufactured by Continental Refrigeration or True Mfg.

ITEM #10 COLD FOOD COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model 4-BCM. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. 8" Stainless steel cutting board, SCB
- 1 ea. Filler panels FLP, where counters meet
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

ITEM #11 FOOD PROTECTOR(S), ADJUSTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model CG. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Gearless adjustment brackets
- 1" Tubular stainless steel posts
- Extend 16" above counter top, overall height
- Anchored below to counter frame for rigidity
- Stainless steel sleeve post extends thru counter top
- 3/8" Tempered glass, horizontal/vertical surfaces

Or as manufactured by Premier or Versa-Gard.

ITEM #12 FLAT TOP COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model 2-ST. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. 8" Stainless steel cutting board, SCB
- 1 ea. Filler panels, FLP, where counters meet
- 1 ea. Open under storage with shelf, ROU

- 1 ea. Duplex receptacle mounted in apron, S.S. cover plates, DOUT
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

ITEM #13 HOT FOOD COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model HF-4. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 208/1, NEMA 6-30P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. Bottom accessible elements
- 1 ea. 8" Stainless steel cutting board, SCB
- 1 ea. Filler panels FLP, where counters meet
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

ITEM #14 FOOD PROTECTOR(S), ADJUSTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model CG. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Gearless adjustment brackets
- 1" Tubular stainless steel posts
- Extend 16" above counter top, overall height
- Anchored below to counter frame for rigidity
- Stainless steel sleeve post extends thru counter top
- 3/8" Tempered glass, horizontal/vertical surfaces

Or as manufactured by Premier or Versa-Gard.

ITEM #15 CASHIER COUNTER, PORTABLE – QTY. AS PER PLAN & SCHEDULE

Piper Products Model 2-CD. Size, shape and installed where shown on drawing. This is a fabricated item and is to be constructed as described in General Specifications and as further detailed on contract drawings. Provided with all features, options and accessories, per quantity required, as indicated:

- Electrical: 120/1, NEMA 5-15P
- Counter Top Material: Stainless Steel, 14 Gauge
- Tray Slide: Solid 3-ribbed tray slide, SRTS
- Front Panels: Formica laminate finish, FRMA, as selected by architect
- End Panels: Formica laminate finish, FRMA, as selected by architect
- Counter Heights: 34" Counter Top, 32" Tray Slide
- 1 ea. Stainless steel tubular foot rest, TFR

- 1 ea. Duplex receptacle mounted in panel, S.S. cover plates, DOUT
- 1 ea. Data/ network port outlet mounted in panel
- Mounted on heavy duty casters, front two with brakes

Or as manufactured by EMI New Jersey and Aero Mfg.

PART 3 - EXECUTION

3.1 GENERAL RELATED CONDITIONS

A. In each item of equipment hereinafter specified under the "Equipment Schedule," these specifications shall only identify each respective item by name and model number, as well as list various component parts/ accessories provided for same.

B. Therefore, it shall be intended that these respective items and their component parts shall be of material (mounted where applicable) constructed and furnished in strict accordance to that described in the general specifications for these items and integrally constructed where applicable.

C. It shall also be intended that where buy-out (pre-fabricated) items are specified, same shall be definitely furnished with all the accessories as normally furnished by manufacturer for these items. Also in strict accordance with current manufacturer's engineering data sheet for each respective item.

D. Should no list or description be provided for various component parts/ accessories, the Kitchen Equipment Contractor is responsible to provide required components for full and proper operation of said equipment.

3.2 EXAMINATION OF PLANS AND SPECIFICATIONS

A. Prospective bidders for this work must examine these plans and specifications carefully before bidding, and must request from Architect and/or Food Service Consultant in writing for an interpretation or correction of every apparent ambiguity, inconsistency or error therein. If necessary, such interpretation or correction shall be issued in writing as an addendum.

3.3 SPECIAL NOTES

A. It shall be the responsibility of Kitchen Equipment Contractor to make as many visits to the job site as is necessary and to keep up to date with progress made in field on the installation of all necessary rough-in to adequately and properly operate and accommodate all equipment furnished by said Contractor and as shown on drawings. Include this service in bid.

B. Kitchen Equipment Contractor to cooperate with all trades so that the end results of his/her work will be a satisfactory, approved and accepted installation. Written reports of each visit shall be sent promptly to the Architect and/or Food Service Consultant.

3.4 COORDINATION

A. Procedure of construction is of paramount importance in executions of this project. Kitchen Equipment Contractor to carry on his/her work so that no delay in his/her operations or those of any other contractors occurs at any time.

B. Kitchen Equipment Contractor to verify with Architect and/or Food Service Consultant as to opening date of the food service area(s), and schedule his/her fabrication and purchasing of equipment so that all will be in readiness, installed, connected, tested, demonstrated, etc., in ample time prior to the scheduled opening date.

3.5 DELIVERY AND INSTALLATION

A. Shall mean and intend that Kitchen Equipment Contractor shall deliver and assemble all equipment of contract in 1 piece in required locations in building, ready for water, waste, gas, electric and ventilating connections required by other trades.

B. Any pieces of equipment may be delivered sectionally, but all working surfaces butt-welded, ground and polished on premises so that upon completion, such item of equipment will have true, smooth, even and continuous surfaces. Butt joining and filling with solder not permitted.

C. Kitchen Equipment Contractor must verify door sizes, delivery platform, elevator size, etc., effecting delivery to food service area(s) for all items of equipment.

3.6 RESERVATIONS AND CONDITIONS

A. It is the intent of this specification to complete the installation of all equipment covered herein in all phases ready for operation. Contractor shall carefully examine the plans and specifications for building construction contracts and determine therefrom the extent of his operations in all respects. All labor and materials not included in building construction contracts necessary to accomplish this intent are hereby included in this contract.

B. Kitchen Equipment Contractor shall attend job meetings when required for purpose of coordinating his/her work with other trades.

C. All equipment shall be received at the building fully protected. It will be the responsibility of the Kitchen Equipment Contractor to protect the equipment until completely installed and accepted.

3.7 NOT USED

END OF SECTION

SECTION 11 6833
SITE AMENITIES

PART 1 GENERAL

1.1 DESCRIPTION

A. The contractor shall provide all labor, materials, equipment and services necessary for and incidental to the installation of outdoor furnishings as shown on the drawings and as specified herein.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

B. American Institute of Steel Construction (AISC)

C. American Welding Society (AWS)

1.3 SUBMITTALS

A. Shop Drawings

1. Indicate locations; pertinent details at minimum of 3/4" scale.

1.4 QUALITY ASSURANCE

A. Manufacturer/Fabricator: Minimum of three (3) years experience of successful experience in the manufacture/fabrication of the type of equipment specified.

B. Installers: Minimum of three (3) years successful experience in the installation of the type of amenity specified.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle all game as recommended by the manufacturer or fabricator, to prevent damage to equipment.

PART 2 PRODUCTS

2.1 PORTABLE PLAYER'S BENCHES

A. Supply and install two (2) single tier aluminum benches with back rest, Model number ATBBRPT15', as manufactured by Sportsfield Specialties, Inc., (888) 975-3343.

B. Benches shall be 15' long, portable and color shall be powdercoated finish 'Azure Blue'.

2.2 WATER FOUNTAIN WITH BOTTLE FILL – ONE (1) TOTAL

A. Provide one (1) as shown on the drawings, Model number LK4400BF as manufactured by Elkay. Construct a 30" diameter concrete pad for bottle fill to be mounted onto.

B. Color shall be: Blue.

2.3 PORTABLE BLEACHERS – TWO (2) TOTAL

A. Furnish and assemble two (2) portable ADA bleachers, 15' Long 3 Row Aluminum Bleachers with (2) ADA – Item #569-1370-1, as manufactured by The Park and Facilities Catalog, www.theparkcatalog.com, 866-293-8528, or approved equal.

2.4 INTERPRETIVE SIGNAGE – ONE (1) TOTAL

A. Supply and install one (1) single leg pedestal, Product ID: 2418 SL SLP-AL/CUSTOM by KVO Industries, Inc., www.kvoindustries.com, 707-573-6868, or approved equal.

B. Color shall be: Cardinal T241-BK59 Black Texture Semi-Gloss, or approved equal.

C. Graphics for panel to be provided and approved by the owner's representative.

2.5 BIKE RACKS – THREE (3) TOTAL

A. Supply and install three (3) Flo Bike Racks, as manufactured by Landscape Forms, Inc. www.landscapeforms.com

B. Color shall be: Powdercoated Steel, Gloss Black, or approved equal.

2.6 SOCCER GOALS

A. Furnish and assemble soccer goals.

B. Model # SG824R – 8'x24' Regulation Size Round Faced Soccer Goals, as manufactured by Sportsfield Specialties, Inc., Regulation Soccer Goals - Sportsfield Specialties, (888) 975-3343, or approved equal.

C. Soccer Wheel Kit: # SGWKL – Levered Soccer Goal External Wheel Kit, as manufactured by Sportsfield Specialties, Inc., Levered 360° Soccer Goal Wheel Kits - Sportsfield Specialties, (888) 975-3343, or approved equal.

D. Soccer Goal Safety System: # SG2S – Stand Alone Soccer Safety System; Safety Clamp and Access Box.

E. Soccer Corner Flags: # SG6B1403 Set of Four (4) – Red Nylon Flags with White Cloth Edges, 5'3"Hx1" O.D. High Impact, White PVC Upright, and 12" Diameter High Density Black Rubber Base.

PART 3 EXECUTION

3.1 ERECTION

A. Construct concrete footings set below finished asphalt course as shown on drawings. Set sleeves plumb, level and true.

B. Check equipment for alignment and hold in position during placement and finishing operations.

C. Erect equipment plumb, level and true.

D. All bolts shall be peened over.

E. Install safety surfacing as per manufacturers' recommendations

3.2 TOUCHING UP

A. After erection and installation are complete, touch up portions damaged during transportation and erection using same finish to match.

PART 4 MEASUREMENT AND PAYMENT

The quantity of SITE AMENITIES to be paid for under this item shall be as described below, constructed in accordance with the plans, specifications and directions of the Engineer. The price bid include all labor, material, equipment and incidental expenses necessary to complete the work, including excavation, installation, maintenance and replacement as required during the course of construction and removal of devices, all in accordance with the plans and specifications to the satisfaction of the Engineer.

++END OF SECTION++

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SECTION 12 3200
PLASTIC LAMINATED CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Provide all plastic laminated casework and accessory items as specified herein. Refer to drawings for specific details, requirements, types and locations.

1. All casework shall be plastic laminate, unless noted otherwise and shall include but not be limited to the following:

a. Base cabinets

b. Wall cabinets.

c. Tall cabinets.

d. Lateral files.

e. Tall cabinets

f. Drawer cabinets.

g. Handicapped accessible workstations

h. Work Stations.

i. Shelf units.

j. Standards and Brackets

k. Solid-surfacing-material countertops and backsplash

l. Metal Grilles

m. Grommets.

n. Cable trays.

o. Separate wood bases for laminated cabinets.

p. Locks master keyed to room doors and other special locks.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section06 1000 - Rough Carpentry for blocking within walls.

B. Section 05 4000 - Cold-Formed Metal Framing.

C. Section 09 2116 - Gypsum Board Assemblies.

D. Section 09 6500 - Resilient Flooring. Base molding furnished and installed.

E. Division 26 Electrical, wiring, outlets, and devices. Furnished and installed by Electrical Contractor.

1.4 DEFINITIONS

A. Identification of casework components and related products by surface visibility.

1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.

2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.

3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.

4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.

5. Semi-Exposed Surfaces: Interior surfaces which are exposed to view when doors or drawers are opened, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.

6. Concealed Surfaces: Any surface not visible after installation

1.5 QUALITY ASSURANCE

A. System Structural Performance: Casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Support Framing System: 600 lb/ft.

2. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft

3. Wall Cabinets (Upper Cabinets): 160 lb/ft.

4. Shelves: 40 lb/ft .

5. Delegated Design: Design casework, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.

6. Seismic Performance: Casework and support framing system or including attachments to other work and shall withstand the effects of earthquake motions determined according to New York State Building Code.

B. Installer Qualifications: A single installer shall perform the work of this section, and shall be a firm with not less than ten (10) continuous years of successful experience in the installation of this work, similar to that required for this project and approved by the manufacturer..

1. The installer shall provide a list of at least five projects of comparable size and similar in design within a fifty mile radius of this project, which may be observed by the representative of the Construction Manager.

2. Provide laminate clad casework and countertops furnished and installed by the same supplier for single responsibility and integration with other building trades.

C. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

1. Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

2. Single Source Manufacturer: Casework and architectural millwork millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework and architectural millwork between multiple manufacturers will not be permitted.

3. Manufacturer shall be member of the Architectural Woodwork Institute and Approved Quality Certification Program.

D. Test data performed and certified by an independent testing agency, covering the following areas of product performance:

1. Base cabinet construction racking test. 990 lbs.

2. Cabinet front joint loading test: 650 lbs.

3. Wall cabinet static load test: 1,850 lbs.

4. Drawer front joint loading test: 940 lbs.

5. Drawer construction/static load test: 920 lbs.

6. Cabinet adjustable shelf support device:

   a. Static load test: 1150 lbs.

7. Particleboard screws holding power: Face: 225 lbs. / Edge: 155 lbs.

E. Casework must conform to design quality of materials, workmanship and function of casework specified and shown on drawings.

F. Design: Door/Drawer overlay cabinet end panels, as reveal overlay design. Door/Drawer and all cabinet body edges to be 3mm PVC as specified herein. Overlay door designs and/or edging other than specified are not acceptable.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Preinstallation Conference: Owner's Representative shall schedule pre-installation meeting three (3) weeks prior to start of work at project site.

1.6 ADA AMERICANS WITH DISABILITIES ACT REQUIREMENTS:

A. The following special requirements shall be met, where specifically indicated on architectural plans as "ADA" or by General Note. To be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:

1. Countertop height: with or without cabinet below not to exceed a height of 34 inches A.F.F. (Above Finished Floor), at a surface depth of 24 inches.

a. Knee space clearance: to be a minimum 27 inches A.F.F., and 30 inches clear span width.

b. 12 inch deep shelving, adjustable or fixed: not to exceed a range from 9 inches A.F.F. to 54 inches A.F.F.

c. Wardrobe cabinets: to be furnished with rod/shelf adjustable to 48 inches A.F.F., and a maximum 21 inch shelf depth.

d. Sink cabinet clearances: in addition to above, upper knee space frontal depth to be no less than 8 inches, and lower toe frontal depth to be no less than 11 inches, at a point 9 inches A.F.F. and as further described in Volume 56, Section 4.19.

e. No cabinets shall be install closer than 18” to the pull side of any door. Co-ordinate with electrical drawings for electrical devices.

1.7 SUBMITTALS

A. Comply with Section 01 3000 - Administrative Requirements, unless otherwise indicated

B. Shop Drawings:

1. Submit CAD production shop drawings prepared by manufacturer for laminate clad casework and countertops showing layout, elevations, ends, cross-sections, service run spaces, specific modifications, component connections, anchorage details, location methods, hardware, and installation procedures .

2. Verify all dimensions and conditions in field.

3. Include layout of units with relation to and clearances of surrounding walls, doors, windows, and other building components.

4. Indicate locations of blocking and reinforcements required for installing casework.

5. Coordinate shop drawings with other work involved.

C. Samples: When requested by Architect and Construction Manager:

1. Submit 2-2" x 3" samples of casework manufacturer's standard decorative laminate colors, patterns and textures, for exposed and semi-exposed materials for Architect's selection. Samples will be reviewed by Architect and Construction Manager for color, texture, and pattern only. Compliance with other specified requirements is the exclusive responsibility of the contractor.

2. Submit one full-size sample base cabinet unit with hardware, doors and drawers, without countertop.

3. Submit one full-size sample wall cabinet unit complete with hardware, doors, and adjustable shelves.

4. Acceptable sample units will be used for comparison inspections at the project. Unless otherwise directed, acceptable sample units may be incorporated in the work. Notify Construction Manager of their exact locations. If not incorporated in the work, retain acceptable sample units in the building until completion and acceptance of the work.

5. Remove sample units from the premises when directed by the Construction Manager

6. Plastic-laminate products, 8 by 10 inches, for each type, color, pattern, and surface finish.

7. Corner pieces as follows:

   a. Miter joints for standing trim.

8. Component samples: Two sets of samples for each of the following:

   a. Decorative laminate color charts, PVC edgings, and Solid surface countertops.

1.8 PRODUCT HANDLING:

A. Deliver laminate clad casework and countertops only after wet operations in building are completed.

B. Store completed laminate clad casework and countertops in a ventilated place, protected from the weather, with relative humidity range of 25% to 55%.

C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with a protective covering.

1.9 JOB CONDITIONS:

A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.

   1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.

   2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.

B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete

1.10 WARRANTY:

A. All materials shall be guaranteed for a period of 5 years from manufacturer's defects and workmanship from date of acceptance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Basis of Design: For purpose of determining minimum performance and quality standards, this specification is based upon drawings, specifications and manufacturer's literature fixed modular, flexible rail mounted, and mobile casework and accessories as manufactured by TMI SYSTEMS CORPORATION, 50 South Third Avenue West, Dickinson, North Dakota, 58601, Phone: 800-456-6716.

1. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

B. Regardless of manufacturer or model numbers indicated, construction shall be in accordance with TMI Systems Corporation and AWI Architectural Woodwork Standards (AWS)s for modular cabinets except where modified by these specifications. Where standard manufacturers' units do not conform to layout and/or dimensions indicated, custom fabricate unit to conform to these specifications unless such non-conformance is specifically approved by the Architect.

1. Submit proof of ability to provide Certificate of Compliance in AWI, Architectural Woodwork Institute Quality Certification Program .

2.2 MATERIALS:

A. Core Materials:

1. All core material shall be a blended bio fiber composition with ultra-low formaldehyde resin system. Board shall exceed performance requirements listed below. Testing for conformance to the listed specifications must be done in accordance with procedures described in the American National Standard for Particleboard (ANSI A208.1 2016 section 5.2 Sampling for Acceptance). Board shall comply with formaldehyde emission requirements for Particleboard in CPA-ECC-2011, ANSI A208.1 2016 and CCR 93120.2 (CARB Composite Wood ATCM Phase II) Casework manufacturer shall provide documentation and certification of use within the entire cabinet. No formaldehyde, no exceptions.

2. Core material shall meet the following average performance requirements: Submit compliance data from the manufacturer prior to fabrication:

a. Density: Minimum 45 lbs.

b. Modulus of Rupture: 1,800 psi.

c. Modulus of Elasticity: 298,000 psi.

d. Average Internal Bond: 80 psi.

e. Screw holding Face: 2 225 lbs.

f. Screw holding Edge: 155 lbs.

g. Thickness Tolerance: 0.003+/- inches.

h. Linear expansion: 0.2%

i. Thickness swell: 5.5%

j. Thickness used are 1/4", 1/2", 3/4" and 1".

k. Plywood: Shall be 9-ply pressure treated hardwood plywood, “A” faced, hardwood veneer.

l. Provide moister resistant core material at sink locations and wet areas:

a) Meeting ANSI MR10 minimum requirements, adding protection against occasional wetting and high humidity.

B. Decorative Laminates:

1. High Pressure Decorative Laminates (HPDL) shall be as follows:

a. Product: “Wilsonart® Solicor™Laminate, Type 160.” Color through the core.

a) Sheet Thickness: 0.048 inch nominal High Wear.

b) Laminate Conformance Standard: NEMA LD 3.

c) Color, Pattern, and Finish:

(a) As indicated on drawings.

b. All laminate shall be counter balanced with heavy gauge neutral colored backing sheet.

2.3 LAMINATE PROPERTIES

A. Laminate Composition: Decorative surface papers impregnated with melamine resins and pressed over kraft paper core sheets impregnated with phenolic resin. Sheets then bonded together under pressures greater than 1,000 lbs. per sq. in. and high temperatures approaching 300 deg F (149 deg C). Finished sheets trimmed and back sanded to facilitate bonding to substrate.

B. Sustainable Design Conformance Standards:

1. UL 2818 GREENGUARD Gold Certified.

2. SCS Certified Indoor Air Quality Advantage™ Gold Certified.

3. SCS Chain of Custody Certified for FSC® Mix, FSC Controlled Wood.

4. SCS Recycled Content Certified.

C. Surface Burning Characteristics:

1. Test Standards: ASTM E 84, ASTM E 162, ASTM E 662, IMO FTP Code Part 2

2. and Part 5, and UL 723.

3. Interior Finish Classification, Fire-Rated Laminate: Class A according to NFPA 101. Flame spread less than 25 and Smoke Developed less than 450

D. Substitutions: Refer to Section 01 2500 - Substitution Procedures.

E. Laminate Color Selection as indicated on drawings are as selected by the Architect. Final acceptance of colors by other manufacturer(s) even if listed, as “acceptable manufactures” shall be at the sole discretion of the Architect.

F. Edgebanding: 3mm PVC banding, machine applied with waterproof hot melt adhesive with external edges and outside corners of door machine profiled to 1/8" radius for safety.

G. Metal Parts: Countertop support brackets, legs and miscellaneous metal parts shall be furniture steel, welded, degreased, cleaned, treated and epoxy powder coated in color selected by the Architect.

2.4 CABINET HARDWARE:

A. Hinges:

1. Shall be five knuckle, epoxy powder coated, institutional grade, 2 3/4" overlay type with hospital tip, eased edges for safety, and a full, 270º door swing for easy access Steel shall be minimum .095" thick and have minimum of nine (9) edge and leaf fastenings. Hinges shall pass ANSI-BHMA standard A156.9, Grade 1 requirement for both vertical and horizontal set and sag (pair of hinges will hold minimum of 310 pounds); copy of test result shall be provided upon request. Casework manufacturer shall use nine specifically engineered screws for attachment of hinges; wood screws shall not be permitted. Doors 48" and over in height shall have three (3) hinges per door.

2. Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.

3. Color: As selected by the Architect.

4. Provide magnetic door catch with minimum seven (7) pound pull, attached with screws and slotted for adjustment. (Not ADA)

B. Pulls:

1. Wire design, Four (4) inches (101.6 mm), in Chrome Coat powder finish, As selecteed by the Architect.

C. Drawer Slides:

1. Standard use and knee space drawers shall be Accuride 3600 series or equal with epoxy coated steel finish. Slides will have a 150 pound load rating a**t full extension a**nd shall be bottom corner mounted with smooth and quiet nylon rollers, a built-in positive stop both directions, with self closing feature. Slides shall have a lifetime warranty as offered by the slide manufacturer.

a. File drawer slides shall be full extension 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers and positive stop in both directions and self-closing feature.

D. Shelf Supports:

1. Shelf Bracket: Steel, prime painted, 1,100 pound capacity per pair:

a. Model: # 287.45.459.

b. Manufacturer: Hafele, www.hafele.com.

c. Provide finish paint coat in field, See Section 09 9000

E. Shelf Bracket: Steel, prime painted, 1,100 pound capacity per pair:

1. Model: # 287.45.459.

2. Manufacturer: Hafele, www.hafele.com.

3. Provide finish paint coat in field, See Section 09 9000

F. Wardrobe Rod: 1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware.

G. File Suspension System: Extruded molding integral with top of drawer box sides to accept standard hanging file folders.

H. Grommets: Mockett, mocket.com; "BRV2" flush mounted, single slot with steel cap.

1. Finish Satin aluminum.

I. Cable/Data Trays: Provide plastic laminate tray where shown on drawings.

J. Metal Grilles: Where metal grilles are indicated for countertops and/or base cabinets to permit thermal heat flow, they shall be as follows:

1. Countertop and Similar Deck Applications: Heavy gauge extruded aluminum construction, bar type, linear design with natural anodized finish. Frame to have a 5/8" perimeter boarder and frame is to have concealed fastenings and reinforcing bands. Exposed screws in top of frame will not be accepted. Core of frame must be removable allowing for cleaning and servicing of fin tubing below and core is to be held in place by spring clips. The core consists of pencil proof design with deflecting bars 1/8" wide and placed on 1/4" centers. Sizes to be as shown on drawings.

a. Model # AAG-100/B frame as manufactured by Advance Architectural Grills, New Hyde Park, NY; 516-488-0628 approved equal.

2. Lengths shall match the length off the baseboard

2.5 LOCKS:

A. Provide for all doors and drawers. Locks shall be, removable core, pin tumbler, cam style lock with strike. Each lock shall be furnished with two (2) keys.

B. Locks shall be keyed alike for each room and MASTERKEYED. Keying shall be reviewed with Construction Manager and approved in writing by the Construction Manager.

C. Chain bolts shall be 3" long, shall have a 18" pull and an angle strike to secure inactive door on cabinets over 72" in height. Elbow catches shall be used on inactive doors-up to and including 72" in height.

2.6 SOLID SURFACING COUNTERTOP

A. Refer to Section 12 3600 - Solid Surfacing Window Sills and Countertops. See drawings.

2.7 FABRICATION

A. Detailed Requirements for Cabinet Construction:

1. Sub-Base: Cabinet Subbase: To be separate and continuous (no cabinet body sides-to-floor), 3/4" water-resistant exterior grade plywood, 4" high, with concealed fastening to cabinet bottom. Ladder-type construction, of front, back and intermediates, to form a secure and level platform to which cabinets attach. Casework with integral sides or sides running to the floor will be rejected.

2. Sub-base at exposed cabinet end panels shall be recessed 1/4 inch (6.4 mm) from face of finished end, for flush installation of finished base material by other trades.

B. Fabricate casework to dimensions, profiles, and details shown.

1. Cabinet Body Construction:

a. Fabricate casework, countertops and related products to dimensions, profiles, and details shown on shop drawings.

b. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and square to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.

c. Solid sub-top shall be furnished for all base and tall cabinets.

d. At cabinets over 36 inches wide, bottoms and tops shall be joined by a fixed vertical divider.

e. Exterior exposed wall cabinet bottoms shall be white thermally fused laminate (TFL) on both sides. Assembly devices shall be concealed on bottom side of wall cabinets

f. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets. (Mechanical or metal hardware fasteners joining cabinet top and bottom panels to the sides will not be accepted.)

a) Tops, bottoms and sides of all cabinets are particleboard core

g. Unless specifically indicated, core shall be 3/4" thick particleboard. Edging and surface finishes as indicated herein.

h. Cabinet backs: 1/4 inch thick medium density fiberboard panel fully captured by the cabinet top, bottom and side panels. Finish to match cabinet interior. 3/4 inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength

a) Exposed back on fixed or movable cabinets to be 3/4" particleboard, color matched to cabinet interior, exterior surface GP28 laminate as selected.

b) Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of 2 at base, 2 at wall, and 3 at tall cabinets.

i. Base units, except sink base units: Full sub-top glued and doweled to cabinet sides. (Mechanical or metal hardware fasteners joining cabinet sub-top panel to the sides will not be accepted.)

a) Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.

j. All end panels and vertical dividers, except sink base units, shall be prepared to receive adjustable shelf hardware at 32mm (approximately 1-1/4") centers. Door hinges, drawer slides and pull-out shelves shall mount on line boring to maintain vertical alignment of components and provide for future relocation of doors, drawers, shelves and/or pull-out shelves.

k. All exposed and semi exposed edges of basic cabinet components shall be factory edged with 3 mm PVC banding, machine applied with waterproof hot melt adhesive. Color as selected by the Architect.

l. Adjustable Shelves in Cabinets

a) Core: Particleboard.

b) Core Thickness: 3/4 inch up to 30 inches wide, 1 inch over 30 inches wide.

c) Edge: 3mm PVC on Front Edge Only

m. Interior finish, units with open Interiors:

a) Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with Thermally Fused Laminate (TFL).

n. Interior finish, units with closed Interiors:

a) Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with Thermally Fused Laminate (TFL).

o. Exposed ends:

a) Faced with high-pressure decorative VGS laminate. Use of TFM on exposed ends will not be permitted.

p. Wall and Tall Unit Tops: (when visible from above):

a) The top edge of all wall and tall unit end panels shall be factory edged with 3mm PVC to match basic cabinet body color; raw edges at top of wall and tall end panels will not be permitted.

b) Top surface will be laminated with melamine in color as selected by the Architect.

q. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), will not be permitted. No exceptions.

C. Drawers:

1. Sides, back and sub front shall be particleboard, 1/2" thick, laminated with TFL in dove gray, frosty white or light beige to match basic cabinet body color. The back and sub front are doweled and glued into the sides. Dowels shall be fluted, with chamfered ends and a minimum diameter of 8 mm. Top edges is banded with 3 mm PVC edging in a matching color.

a. Drawer bottom shall be particleboard, 1/2" thick, laminated with TFL in color to match basic cabinet body color, screwed directly to the bottom edges of the drawer box. Drawer bottom less than 1/2" thick will not be permitted.

b. Paper storage drawers: Minimum 3/4 inch thick particleboard sides, back, and sub front laminated with Thermally Fused Laminate (TFL).. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer

c. Painted finishes on drawer sides and/or bottom will not be permitted.

D. Door/Drawer Fronts:

1. Laminated door and drawer fronts shall be 13/16 inch (20.6 mm) finished thickness for all hinged and sliding doors. Drawer fronts and hinged doors shall overlay cabinet end panels, as reveal overlay design the cabinet body. Maintain a maximum 1/8 inch (3.2 mm) reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.

2. Double doors shall be used on all cabinets in excess of 24" wide.

3. Exterior faces shall be laminated with high pressure decorative laminate specified, color as selected. Interior face shall be high balanced with pressure cabinet liner CL20.

4. All edges shall be finished with 3mm PVC available in color as selected by the Architect. External edges and outside corners shall be machine profiled to 1/8” radius.

PART 3 - EXECUTION

3.1 INSPECTION:

A. The installer must examine the jobsite and the conditions under which the work under this section is to be performed, and notify the contractor in writing of unsatisfactory conditions. Do not proceed with work under this section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 PREPARATION:

A. Condition laminate clad casework to average prevailing humidity conditions in installation areas prior to installing.

3.3 COORDINATION:

A. Verify site dimensions of cabinet locations in building prior to fabrication.

B. Coordinate layout and installation of framing and reinforcements for support of casework, and equipment furnished by others and installed in casework..

C. Coordinate installation of roughing with other prime contractors.

D. Coordinate layout and installation of framing and reinforcements for support of casework.

E. Coordinate installation of casework with installation of other casework equipments and accessories

3.4 INSTALLATION OF CABINETS

A. Install all base cabinets on a separate wood base.

B. Install insulation to rear of cabinets as detailed.

C. Install level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.

2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.

3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.

4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.

5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

6. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

   a. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.

7. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c.

8. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

9. Adjust casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

D. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.

E. All fasteners shall be approved by the Architect and provide with screw caps or approved washers. Gypsum board screws are not permitted.

3.5 INSTALLATION OF COUNTERTOPS

A. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.

1. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.

a. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

2. Fastening:

a. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.

b. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.

a) Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

3. Provide required holes and cutouts for service fittings.

a. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

b. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

c. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.6 PROTECTION

A. Storage and Protection: Casework shall be protected in storage. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes. Store off the floor to prevent chipping of laminate. Do not store or install casework in building until concrete, masonry or other wet trades are dry.

3.7 ADJUSTING

A. Repair or remove and replace defective work, as directed by Construction Manager upon completion of installation.

B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

3.8 CLEANING AND PROTECTION:

A. Repair or remove and replace defective work as directed upon completion of installation.

1. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts or units.

2. Remove all cartons, debris, sawdust, scraps, etc. and leave space ready for final cleaning.

3. Protect all casework and tops from damage by other trades until acceptance of the work by the Construction Manager.

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Storm-water piping exposed to freezing conditions.
7. Roof drains and rainwater leaders.
8. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material test reports.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Owens Corning.

2. Preformed Pipe Insulation: Type II, Class 1, unfaced.
3. Preformed Pipe Insulation: Type II, Class 2, with factory-applied [ASJ] [ASJ-SSL] [ASJ+] [PSK] jacket.
4. Fabricated shapes in accordance with ASTM C450, ASTM C585, and ASTM C1639.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F (minus 57 deg C) and 220 deg F (104 deg C). Comply with ASTM C534/C534M, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aeroflex USA.
    b. Armacell LLC.
    c. K-Flex USA.

H. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F (454 deg C) in accordance with ASTM C411. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. Knauf Insulation.
    c. Manson Insulation Inc.
    d. Owens Corning.

2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

I. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F (650 deg C) in accordance with ASTM C447. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Johns Manville; a Berkshire Hathaway company.
   b. Owens Corning.
   c. ROCKWOOL.

2. Preformed Pipe Insulation: Type II, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

J. Polyolefin: Polyethylene thermal plastic insulation. Comply with ASTM C534/C534M or ASTM C1427, Type I, Grade 1, for tubular materials, self-seal.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Armacell LLC.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Foster Brand; H. B. Fuller.

C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Aeroflex USA.
   b. Armacell LLC.
   c. K-Flex USA.
2. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
3. Wet Flash Point: Below 0 deg F (minus 18 deg C).
4. Service Temperature Range: 40 to 200 deg F (4 to plus 93 deg C).
5. Color: [Black] <Insert color>.

D. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Mon-Eco Industries, Inc.

E. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Mon-Eco Industries, Inc.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. The Dow Chemical Company.

2.4 MASTICS AND COATINGS

A. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Childers Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
d. Mon-Eco Industries, Inc.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
5. Color: [White].

B. Breather Mastic: Water based; suitable for indoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. Childers Brand; H. B. Fuller Construction Products.
b. Knauf Insulation.

2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm (0.66 metric perms) at manufacturer's recommended dry film thickness.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: [White].

2.5 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Mon-Eco Industries, Inc.
c. Owens Corning.

2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 58 to plus 176 deg F (Minus 50 to plus 80 deg C).
4. Color: White or gray.

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. ASJ+: Aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film leaving no paper exposed; complying with ASTM C1136, Types I, II, III, IV, and VII.
5. PSK Jacket: Aluminum foil fiberglass reinforced scrim with polyethylene backing, complying with ASTM C1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Airex Manufacturing Inc.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Proto Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Owens Corning.
    b. Polyguard Products, Inc.

E. Self-Adhesive Outdoor Jacket (Asphaltic): 60-mil- (1.5-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. MFM Building Products Corp.
    b. Polyguard Products, Inc.

F. Self-Adhesive Indoor/Outdoor Jacket (Non-Asphaltic): Vapor barrier and waterproofing jacket for installation over insulation located aboveground outdoors or indoors. Specialized jacket has five layers of laminated aluminum and polyester film with low-temperature acrylic pressure-sensitive adhesive. Outer aluminum surface is coated with UV-resistant coating for protection from environmental contaminants.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M.
    b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Permeance: 0.00 perm as tested in accordance with ASTM F1249.
3. Flamespread/Smoke Developed: 25/50 as tested in accordance with ASTM E84.
4. Aluminum Finish: Embossed.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Mesh: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Foster Brand; H. B. Fuller.
    b. Vimasco Corporation.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Aeroflex USA.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.
c. Knauf Insulation.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.10 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Johns Manville; a Berkshire Hathaway company.

2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire Products.
b. Johns Manville; a Berkshire Hathaway company.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, sheet P-100A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Truebro; IPS Corporation.
b. Zurn Industries, LLC.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures, sheet P-100A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ProFlo; a Ferguson Enterprises, Inc. brand.
b. Truebro; IPS Corporation.
c. Zurn Industries, LLC.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the contract documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall, Partition and Floor Penetrations: Install insulation continuously through penetrations of fire-rated walls, partitions and floors.

1. Meet or exceed fire rated assembly penetrations with approved Underwriter Laboratories firestopping insulation and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, and Unions:

1. Install insulation over fittings, valves, strainers, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-

box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, two locations of threaded strainers, and three locations of threaded valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: [1-1/2 inch (25 mm)] thick.

B. Domestic Hot and Recirculated Hot Water:

1. [NPS 1-1/4 (DN 32)] and Smaller: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1-1/2 inch (25 mm) thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: [1-1/2 inch (25 mm)] thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1-1/2 inch (25 mm) thick.

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   b. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch (25 mm) thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. If more than one material is listed, selection from materials listed is Contractor's option.

B. Piping, Concealed:

1. None.

C. Piping, Exposed:
1. PVC: 20 mils (0.5 mm) thick.

3.13 UNDERGROUND, FIELD-APPLIED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 22 1116
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract the State of New York Standard Construction Contract.

B. Work Included: Provide Domestic water piping in accordance with the Contract Documents." The "General Conditions Governing All Contracts" shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

C. Section Includes:

1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.
5. Backflow preventers and vacuum breakers.
6. Escutcheons.
7. Sleeves and sleeve seals.
8. Water penetration systems.

B. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Elkhart Products Corporation; Industrial Division.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.

    b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

6. Copper-Tube Extruded-Tee Connections:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) T-DRILL Industries Inc.

    b. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

A. Comply with requirements in Division 221119 Section "Domestic Water Piping Specialties" for backflow preventer.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Hart Industries International, Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 175 psig (1200 kPa) minimum.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

   a. Calpico, Inc.
   b. Lochinvar Corporation.

2. Description:

   a. Galvanized-steel coupling.
   b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
   c. End Connections: Female threaded.
   d. Lining: Inert and noncorrosive, thermoplastic.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

   a. Perfection Corporation; a subsidiary of American Meter Company.
   b. Precision Plumbing Products, Inc.
   c. Victaulic Company.

2. Description:

   a. Electroplated steel nipple complying with ASTM F 1545.
   b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
   c. End Connections: Male threaded or grooved.
   d. Lining: Inert and noncorrosive, propylene.

2.6 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated or rough-brass finish with setscrews.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.

E. Split Casting, Cast Brass: Polished, chrome-plated or rough-brass finish with concealed hinge and setscrew.

F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.

G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.7 SLEEVES

A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

D. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

G. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.8 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex, Inc.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install shutoff valve immediately upstream of each dielectric fitting.

C. Install domestic water piping level and plumb.

D. Install seismic restraints on piping.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping adjacent to equipment and specialties to allow service and maintenance.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

G. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

3.6 HANGER AND SUPPORT INSTALLATION

A. Hangers and Supports for Plumbing Piping and Equipment.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.

G. Install supports for vertical steel piping every 15 feet (4.5 m).

H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.8 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with rough-brass finish.
5. Bare Piping in Equipment Rooms: One piece, cast brass.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.9 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants" for joint sealants.

G. Seal space outside of sleeves in concrete slabs and walls with grout.

H. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

I. Install sleeve materials according to the following applications:

1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.

    a. Extend sleeves 2 inches (50 mm) above finished floor level.
    b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.

3. Sleeves for Piping Passing through Gypsum-Board Partitions:

    a. PVC pipe sleeves for pipes smaller than NPS 6 (DN 150).
    b. Galvanized-steel sheet sleeves for pipes NPS 6 (DN 150) and larger.
    c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

4. Sleeves for Piping Passing through Interior Concrete Walls:

    a. Steel pipe sleeves for pipes smaller than NPS 6 (DN 150).

J. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 7 Section "Penetration Firestopping" for firestop materials and installations.

3.10 SLEEVE SEAL INSTALLATION

A. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 15 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by the State of New York.
2. During installation, notify the State of New York at least one day before inspection must be made. Perform tests specified below in presence of the State of New York:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for the State of New York to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If the State of New York find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by the State of New York.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Sterilization:

1. The entire domestic water system shall be thoroughly sterilized with chlorine before acceptance for domestic operation.
2. The amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million for 24 hours or 200 p.pm. for one hour. The chlorinating material shall be either liquid chlorine or sodium hypochlorite solution and shall be introduced into the system and drawn to all points of the system. If possible, to do so, the lines shall be thoroughly flushed before introduction of the chlorinating material. After a contact period of not less then 24 hours, the system shall be flushed with clean water until the residual content is not greater than 0.2 parts per million. All valves in the lines being sterilized shall be opened and closed several times during the contact period.
3. Sterilization and tests for purity of water in the entire piping system shall be performed by the Contractor through an approved independent testing laboratory and a certificate shall be furnished to the Architect certifying the quality of purity.
4. Per ANSI/AWWA Standard C651-15.

3.13 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
5. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.14 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought- copper solder-joint fittings; and soldered joints.
3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
4. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper push-on-joint fittings; and push-on joints.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller.
2. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 22 11 16

SECTION 22 1119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract the State of New York Standard Construction Contract.

B. Work Included: Provide Domestic water piping specialties in accordance with the Contract Documents. The “General Conditions Governing All Contracts” shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1. Backflow preventers.

2. Hose Bibbs.

C. Related Sections include the following:
1. Division 221116 Section "Domestic Water Piping".

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers RPZ-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawing P-001 or a comparable product by one of the following or approved equal:

a. Ames Co.

b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Watts Industries, Inc.; Water Products Div.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Size: as specified.
5. Configuration: Designed for horizontal, straight through flow.
6. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Vacuum Breaker Wall Hydrants HB-1:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Arrowhead Brass Products.
b. Mansfield Plumbing Products LLC.
c. McDonald, A. Y. Mfg. Co.
d. Prier Products, Inc.
e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
g. Woodford Manufacturing Company; a division of WCM Industries, Inc.
h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

2. Standard: ASSE 1019, Type A.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed.
5. Pressure Rating: 125 psig (860 kPa).
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.2 HOSE BIBBS

A. Hose Bibbs HB-2:

1. Standard: ASME 1052.
2. Body Material: Brass.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Rest Rooms: Rough chrome.
9. Operation for Rest Rooms: Operating key.
10. Include operating key with each operating-key hose bibb.

2.3 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. PPP Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    g. Tyler Pipe; Wade Div.
    h. Watts Drainage Products Inc.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

A. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    b. ProSet Trap Guard.

2. Standard: ASSE 1072-07, Barrier type floor drain trap seal protection.
3. Size: NPS 3” (DN 80) minimum.
4. Material: Elastomeric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

END OF SECTION 22 11 19

SECTION 22 1316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract the State of New York Standard Construction Contract.

B. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

C. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) ANACO.

2) Fernco, Inc.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.

2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) ANACO.
2) Clamp-All Corp.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.

3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.

a. Available Manufacturers:

1) MG Piping Products Co.

2.5 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.

B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.

C. Pressure Fittings:

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
4. Cast-Iron Flanges: ASME B16.1, Class 125.
5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

D. Grooved-Joint Systems:

1. Available Manufacturers:

a. Anvil International.
b. Star Pipe Products; Star Fittings Div.
c. Victaulic Company.
d. Ward Manufacturing, Inc.

2. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, galvanized, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.

3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.6 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Gaskets: Lip seals shaped to fit socket groove, with plastic backup ring.

1. Material: EPDM, unless NBR is indicated.

2.7 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint Systems:

1. Available Manufacturers:

a. Victaulic Company.

2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.8 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. Dallas Specialty & Mfg. Co.
b. Fernco, Inc.

c. Logan Clay Products Company (The).
d. Mission Rubber Co.
e. NDS, Inc.
f. Plastic Oddities, Inc.

2. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Mission Rubber Co.

C. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Available Manufacturers:

a. EBAA Iron Sales, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products; Star Fittings Div.

D. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Available Manufacturers:

a. SIGMA Corp.

2.10 SPECIAL WASTE & VENT PIPING

1. CPVC Chemical Waste Drainage System

A. Joints: Solvent welded with ASTM F493 cement.

B. CPVC Drainage Pipe and Fittings: Shall be manufactured from CPVC type IV Grade 1 compounds with a minimum cell class of 23447. Pipe and Fittings shall conform to ASTM F2618. Schedule 40 pipe, and socket type (solvent cement) drainage pattern fittings

C. Use one step solvent cement specially formulated for CPVC Chemical Waste applications that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and conforms to ASTM F493

D. All pipe, fittings, and cement shall be certified by NSF International for use with Chemical Waste Drainage Systems and shall bear the mark “NSF-cw”.

E Installation shall be in accordance with manufacturer’s instructions and all applicable code requirements

F. CPVC: ASTM F 2618. P-traps [with] or [without union], with solvent weld connections, jar traps with solvent cement connection.

G. Acceptable Manufacturers: ChemDrain by Charlotte Pipe and Foundry Co., or approved equal.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
5. Copper DWV tube, copper drainage fittings, and soldered joints.

C. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper DWV tube, copper drainage fittings, and soldered joints.
    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints.
6. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) shall be any of the following:

1. Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
2. Steel pipe, pressure fittings, and threaded joints.

3.2 PIPING INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

C. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

G. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

I. Install aboveground PVC piping according to ASTM D 2665.

J. Install underground CPVC piping according to ASTM D 2321.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

E. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.4 VALVE INSTALLATION

A. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
2. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.

B. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.

2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.

I. Install supports for vertical steel piping every 15 feet (4.5 m).

J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 96 inches (2400 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 (DN 100): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.

K. Install supports for vertical stainless-steel piping every 10 feet (3 m).

L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

M. Install supports for vertical copper tubing every 10 feet (3 m).

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 22 1319
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract the State of New York Standard Construction Contract.

B. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Through-penetration firestop assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.
    g. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company; Josam Div.
    b. Oatey.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Zurn Plumbing Products Group; Light Commercial Operation.
    h. Zurn Plumbing Products Group; Specification Drainage Operation.
    i. Josam Company; Josam Div.
    j. Kusel Equipment Co.
    k. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    l. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with set-screws or other device.
10. Frame and Cover Material and Finish: Rough bronze.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

D. Cast-Iron Floor Drains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Commercial Enameling Co.
   b. Josam Company; Josam Div.
   c. MIFAB, Inc.
   d. Prier Products, Inc.
   e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   f. Tyler Pipe; Wade Div.
   g. Watts Drainage Products Inc.
   h. Zurn Plumbing Products Group; Light Commercial Operation.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.

2.2 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Acorn Engineering Company; Elmdor/Stoneman Div.
   b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install roof flashing assemblies & fittings on sanitary stack vents and vent stacks that extend through roof.

F. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install vent caps on each vent pipe passing through roof.

L. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

M. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

N. Install wood-blocking reinforcement for wall-mounting-type specialties.

O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Secure flashing into sleeve and specialty clamping ring or device.

D. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319

SECTION 230130

EXISTING HVAC AIR DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cleaning existing HVAC air-distribution equipment, ducts, plenums, and system components.

1.2 DEFINITIONS

A. ACAC: American Council for Accredited Certification.

B. AIHA-LAP: American Industrial Hygiene Association Lab Accreditation Program

C. ASCS: Air systems cleaning specialist.

D. CESB: Council of Engineering and Scientific Specialty Boards.

E. CMI: Certified Microbial Investigator.

F. CMC: Certified Microbial Consultant.

G. CMR: Certified Microbial Remediator.

H. CMRS: Certified Microbial Remediation Supervisor.

I. EMLAP: Environmental Microbiology Laboratory Accreditation Program.

J. IEP: Indoor Environmental Professional.

K. IICRC: Institute of Inspection, Cleaning, and Restoration Certification.

L. NADCA: National Air Duct Cleaners Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. ASCS Qualifications: A certified member of NADCA

1. Certification: Employ an ASCS certified by NADCA on a full-time basis
2. Supervisor Qualifications: Certified as an ASCS by NADCA

B. IEP Qualifications: CMI who is certified by ACAC and accredited by CESB.

C. IEP Qualifications: CMC who is certified by ACAC and accredited by CESB.

D. CMR Qualifications: Certified by ACAC and accredited by CESB.

E. CMRS Qualifications: Certified by ACAC and accredited by CESB.

PART 2 - PRODUCTS

2.1 HVAC CLEANING AGENTS

A. Description:

1. Formulated for each specific soiled coil condition that needs remedy.

2.2 ANTIMICROBIAL SURFACE TREATMENT

A. Description: Specific product selected shall be as recommended by the IEP based on the specific antimicrobial needs of the specific Project conditions.

1. Formulated to kill and inhibit growth of microorganisms.
2. EPA-registered for use in HVAC systems and for the specific application in which it will be used.
3. Have no residual action after drying, with zero VOC off-gassing.
4. OSHA compliant.
5. Treatment shall dry clear to allow continued visual observation of the treated surface.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspect HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.

B. Cleaning Plan: Prepare a written plan for air-distribution system cleaning that includes strategies and step-by-step procedures.

C. Proceed with work only after conditions detrimental to performance of the Work have been corrected and cleaning plan has been approved.

D. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.

E. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning.

3.2 CLEANING

A. Comply with NADCA ACR.

B. Perform electrical lockout and tagout according to Owner's standards or authorities having jurisdiction.

C. Remove non-adhered substances and deposits from within the HVAC system.

D. Systems and Components to Be Cleaned: All air-moving and -distribution equipment.

E. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.

1. Particulate Collection: For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,

F. Control odors and mist vapors during the cleaning and restoration process.

G. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.

H. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.

I. Clean all air-distribution devices, registers, grilles, diffusers, louvers, and insect screens.

J. Clean non-adhered substance deposits according to NADCA ACR and the following:

1. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
2. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
3. Clean evaporator coils, reheat coils, and other airstream components.

K. Air-Distribution Systems:

1. Create service openings in the HVAC system as necessary to accommodate cleaning.
2. Mechanically clean air-distribution systems specified to remove all visible contaminants, so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).

L. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.

M. Mechanical Cleaning Methodology:

1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.

    a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
    b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials, such as duct and plenum liners.

2. Cleaning Mineral-Fiber Insulation Components:

    a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR.
    b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR).
    c. Fibrous materials that become wet shall be discarded and replaced.

N. Coil Cleaning:

1. See NADCA ACR, "Coil Surface Cleaning" Section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing coil cleaning verification.
2. Coil drain pans shall be subject to NADCA ACR, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
3. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
4. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations.
5. Rinse thoroughly with clean water to remove any latent residues.

O. Application of Antimicrobial Treatment:

1. Apply antimicrobial agents and coatings if active fungal growth is determined by the IEP to be at Condition 2 or Condition 3 status according to IICRC S520, as analyzed by a laboratory accredited by AIHA-LAP with an EMLAP certificate and with results interpreted by an IEP. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
2. Apply antimicrobial treatments and coatings after the system is rendered clean.
3. Apply antimicrobial agents and coatings directly onto surfaces of interior ductwork.
4. Microbial remediation shall be performed by a qualified CMR and CMRS.

3.3 CLEANLINESS VERIFICATION

A. Verify cleanliness according to NADCA ACR, "Verification of HVAC System Cleanliness" Section.

B. Surface-Cleaning Verification: Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

C. Verification of Coil Cleaning: Coil will be considered clean if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.

D. Prepare a written cleanliness verification report.

3.4 RESTORATION

A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR, "Restoration and Repair of Mechanical Systems" Section.

B. Restore service openings capable of future reopening. Comply with requirements in Section 233113 "Metal Ducts”.

C. Reseal fibrous-glass ducts. Comply with requirements in Section 233116 "Nonmetal Ducts."

D. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts."

E. Replace damaged insulation according to Section 230713 "Duct Insulation."

F. Ensure that closures do not hinder or alter airflow.

G. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

H. Restore manual volume dampers and air-directional mechanical devices inside the system to their marked position on completion of cleaning.

END OF SECTION 230130

SECTION 23 0485

COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1) Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2) Verify and document proper performance of equipment and systems.
3) Verify that O&M documentation left on site is complete.
4) Verify that the Owner's operating personnel are adequately trained.

B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

C. Abbreviations. The following are common abbreviations used in this Specification and in the Commissioning Plan to be developed. Definitions are found in Section 1.6.

A/E-	Architect and design engineers	FT-	Functional performance test
CA-	Commissioning authority	GC-	General contractor (prime)
CC	Controls contractor	MC-	Mechanical contractor
CM-	Construction Manager (the owner's representative)	PC-	Prefunctional checklist
Cx-	Commissioning	PM-	Project manager (of the Owner)
Cx Plan-	Commissioning Plan document	Subs-	Subcontractors to General
EC-	Electrical contractor	TAB-	Test and balance contractor

1.2 COORDINATION

A. Commissioning Team. The members of the commissioning team consist of the Commissioning authority (CA), the Project Manager (PM), , the General Contractor (GC or Contractor), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

B. Management. The CA directs and coordinates the commissioning activities.

C. Scheduling. The CA will work with the Contractor according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the Contractor for scheduling commissioning activities. The Contractor will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

The Contractor will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The *Commissioning Plan—Construction Phase* shall provide a format for this schedule. As construction progresses more detailed schedules are developed by the CA. The Commissioning Plan shall also provide a format for detailed schedules.

1.3 COMMISSIONING PROCESS

A. Commissioning Specifications. The commissioning specifications shall be provided as part of the bid documents and is binding on the Contractor. The commissioning plan provides guidance in the execution of the commissioning process. The CA shall present a preliminary *Commissioning Plan* for the Construction Phase at the pre-construction or initial commissioning coordination meeting. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The *Specifications* will take precedence over the *Commissioning Plan*.

B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
3. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.
4. The CA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with prefunctional checklists to be completed, during the startup process.
5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.

6. The Subs, under their own direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.
7. The CA develops specific equipment and system functional performance test procedures. The Subs review the procedures.
8. The procedures are executed by the Subs, under the direction of, and documented by, the CA.
9. Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.
10. The CA reviews the O&M documentation for completeness.
11. Commissioning is completed before Substantial Completion.
12. The CA reviews, pre-approves and coordinates the training provided by the Subs and verifies that is was completed.
13. Deferred testing is conducted, as specified or required.

1.4 RELATED WORK

A. Specific commissioning requirements shall be given in and/or amended to the following sections of these specifications. All of the following sections apply to the Work of this section.

15900 Instrumentation and Control for HVAC Lists special requirements and alerts the controls contractor of the special requirements of the control contractor and control system.

15950 Testing, Adjusting and Balancing (TAB). Alerts the TAB of Cx responsibilities.

1.5 RESPONSIBILITIES

A. Commissioning Authority (CA)

The CA (if not also the designer) is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving of non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CA.

Construction and Acceptance Phase

1. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
2. Coordinate the commissioning work and, with the Contractor, ensure that commissioning activities are being scheduled into the master schedule.
3. Develop and revise, as necessary, the *Commissioning Plan—Construction Phase.*
4. Plan and conduct a commissioning scoping meeting and other commissioning meetings.

5. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
6. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
7. Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
8. Write and distribute prefunctional tests and checklists.
9. Develop an enhanced start-up and initial systems checkout plan with Subs.
10. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
11. Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owners project manager of any deficiencies in results or procedures.
12. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
13. Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
14. Approve systems startup by reviewing start-up reports and by selected site observation.
15. Review TAB execution plan.
16. Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
17. Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.
18. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing. Submit to the A/E and PM for review, and for approval if required.
19. Analyze any functional performance trend logs and monitoring data to verify performance.
20. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved. Perform actual functional testing without contractors on any equipment so specified in Section 230800
21. Maintain a master deficiency and resolution log and a separate testing record. Provide the A/E and PM with written progress reports and test results with recommended actions.
22. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
23. Oversee and approve the training of the Owner's operating personnel.
24. Compile and maintain a commissioning record and building systems book(s).
25. Review and approve the preparation of the O&M manuals.
26. Provide a final commissioning report (as described in this section).

Warranty Period

1. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
2. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the

original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

B. Contractor

Construction and Acceptance Phase

1. Facilitate the coordination of the commissioning work by the CA, and with the Contractor and CA ensure that commissioning activities are being scheduled into the master schedule.
2. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
3. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
4. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
5. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
6. Coordinate the training of owner personnel.
7. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

Warranty Period

1. Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
2. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

C. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA.
4. Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.
5. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
6. Review test procedures for equipment installed by factory representatives.

1.6 DEFINITIONS

Acceptance Phase - phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

Architect / Engineer (A/E) - the architect and engineering consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

Commissioning authority (CA) - an independent agent, not otherwise associated with the A/E team members or the Contractor. The CA directs and coordinates the day-to-day commissioning activities

Commissioning Plan - an overall plan, developed after bidding that provides the structure, schedule and coordination planning for the commissioning process.

Control system - the central building energy management control system (or DDC System).

Datalogging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

Deferred Functional Tests - FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

Design Intent - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.

Factory Testing - testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

Functional Performance Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.

Indirect Indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

Non-Compliance - see Deficiency.

Non-Conformance - see Deficiency.

Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

Owner-Contracted Tests - tests paid for by the Owner outside the GC's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

Prefunctional Checklist (PC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.

Project Manager (PM) - the contracting and managing authority for the owner over the design and/or construction of the project, a staff position.

Sampling. - functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Section 019113, Part 3.6, F for details.

Seasonal Performance Tests - FT that are deferred until the system(s) will experience conditions closer to their design conditions.

Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

Startup - the initial starting or activating of dynamic equipment, including executing prefunctional checklists.

Test Procedures - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Division 23 Specifications.(

Trending - monitoring using the building control system.

Vendor - supplier of equipment.

Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.7 SYSTEMS TO BE COMMISSIONED

A. All equipment depicted in mechanical equipment schedules and controls riser diagrams will be commissioned in this project.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, except for stand-alone datalogging equipment that may be used by the CA.

C. Datalogging equipment and software required to test equipment will be provided by the CA, but shall not become the property of the Owner.

D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the *Specifications.* All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

E. Refer to Section 019113, Part 3.6 E for details regarding equipment that may be required to simulate required test conditions.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting. Within 60 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the *Commissioning Plan* to its "final" version, which will also be distributed to all parties.

B. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize

unnecessary time being spent by Subs. For large projects, these meetings may be held monthly, until the final 3 months of construction when they may be held as frequently as one per week.

3.2 REPORTING

A. The CA will provide regular reports to the PM, depending on the management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in the *Commissioning Plan.*

B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

D. A final summary report (about four to six pages, not including backup documentation) by the CA will be provided to the PM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. Prefunctional checklists, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the O&M manuals.

3.3 SUBMITTALS

A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning authority. All documentation requested by the CA will be included by the Subs in their O&M manual contributions.

B. The Commissioning authority will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

C. The CA may request additional design narrative from the Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

D. These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

A. The following procedures apply to all equipment to be commissioned, according to Section 1.7, Systems to be Commissioned. Some systems that are not comprised so much of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and startup.

B. General. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

C. Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms. Parties responsible for executing functional performance tests are identified in the testing requirements in Section 230800.

1. The CA develops, if necessary, the representative prefunctional checklists based on the examples provided in this Section 019113. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution. The checklists will be provided as part of the *Commissioning Plan – Construction Phase*.
2. These checklists and tests are provided by the CA to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
3. The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.

   The full start-up plan could consist of something as simple as:
   a. The CA's prefunctional checklists.
   b. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
   c. The manufacturer's normally used field checkout sheets.

4. The subcontractor submits the full startup plan to the CA for review and approval.
5. The CA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
6. The full start-up procedures and the approval form may be provided to the A/E or PM for review and approval, depending on management protocol.

D. Sensor and Actuator Calibration.
All field-installed temperature, relative humidity, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

Sensor Calibration Methods

All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable, are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.

Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA or 0 VDC is read by the ammeter/voltmeter. Repeat for the maximum temperature matching 20 mA or 10VDC to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

Critical Applications. For critical applications (process, manufacturing, etc.) more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

Tolerances, Standard Applications

Sensor	Required Tolerance (+/-)	Sensor	Required Tolerance (+/-)
Cooling coil, chilled and condenser water temps	0.4F	Flow rates, water	4% of design
AHU wet bulb or dew point	2.0F	Relative humidity	2% of design
Hot water coil and boiler water temp	1.0F		

Outside air, space air, duct air temps	0.4F
CO_2 monitor	0.1 % pts
Pressures, air, water and gas	3% of design

Valve and Damper Stroke Setup and Check
EMS Readout. For all valve and damper actuator positions checked, verify the actual position against the BAS readout.
Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions.
Closure for heating coil valves (NO): Set heating setpoint 20°F above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 20°F below room temperature. Observe the valve close. Restore to normal.

Closure for cooling coil valves (NC): Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. Restore to normal.

E. Execution of Prefunctional Checklists and Startup.

1. Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the, Contractor and CA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.
2. The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as approved by the A/E). In no case will the number of units witnessed be less than four on any one building, nor less than 20% of the total number of identical or very similar units.
3. For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the prefunctional and start-up procedures. The sampling procedures shall be identified in the commissioning plan.
4. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
5. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

F. Deficiencies, Non-Conformance and Approval in Checklists and Startup.

1. The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.
2. The CA reviews the report and submits either a non-compliance report or an approval form to the Sub or PM. The CA shall work with the Subs and vendors to correct and retest

deficiencies or uncompleted items. The CA will involve the Contractor and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the Contractor using a standard form.

3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party. Refer to Part 3.7 herein for details.

3.5 PHASED COMMISSIONING

A. Phasing will be planned and scheduled, if necessary, in a coordination meeting of the CA, , mechanical, TAB and controls and the Contractor. Results will be added to the master and commissioning schedule.

3.6 FUNCTIONAL PERFORMANCE TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.

B. The general list of equipment to be commissioned is found in Section 019113, Part 1.7. The specific equipment and modes to be tested are found in the Division 23 Sections

C. The parties responsible to execute each test are listed with each test in Section 230800

D. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are given in the Division 23 Sections .

E. Development of Test Procedures. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in Division 23 , the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.

The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.

The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

The test procedure forms developed by the CA shall include (but not be limited to) the following information:

1. System and equipment or component name(s)
2. Equipment location and ID number
3. Unique test ID number, and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment
4. Date
5. Project name
6. Participating parties
7. A copy of the specification section describing the test requirements
8. A copy of the specific sequence of operations or other specified parameters being verified
9. Formulas used in any calculations
10. Required pre-test field measurements
11. Instructions for setting up the test.
12. Special cautions, alarm limits, etc.
13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
15. A section for comments
16. Signatures and date block for the CA

F. Test Methods.

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. Division 23 sections specify which methods shall be used for each test. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the A/E. This may require a change order and adjustment in charge to the Owner. The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the

value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

4. Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
5. Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.
6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
7. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
8. Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

   A common sampling strategy referenced in the *Specifications* as the "xx% Sampling—yy% Failure Rule" is defined by the following example.

   xx = the percent of the group of identical equipment to be included in each sample.
   yy = the percent of the sample that if failing, will require another sample to be tested.

   The example below describes a 20% Sampling—10% Failure Rule.

   a. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
   b. If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
   c. If 10% of the units in the second sample fail, test all remaining units in the whole group.
   d. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

G. Coordination and Scheduling. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems.

The CA will schedule functional tests through the, Contractor. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

H. Test Equipment. Refer to Section 019113, Part 2.1 for test equipment requirements.

3.7 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractor for review and approval. The CA will include the filled out forms in the O&M manuals.

B. Non-Conformance.

1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the Contractor on a standard non-compliance form.
2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the PM.
4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
    a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
        1) The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the Contractor for signature, if required. A copy is provided to the Sub and CA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
        2) The CA reschedules the test and the test is repeated.

    b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

1) The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the GC and to the Sub representative assumed to be responsible.
2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E.
3) The CA documents the resolution process.
4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. Cost of Retesting.

   a. The cost to retest a prefunctional or functional test, if the Contractor is responsible for the deficiency, shall be born by the Contractor.
   b. For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CA will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CA's time for a second retest will be charged to the GC, who may choose to recover costs from the responsible Sub.
   c. The time for the CA to direct any retesting required because a specific *prefunctional* checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the Contractor,.
   d. Refer to the sampling section of 019113, Part 3.6 for requirements for testing and retesting identical equipment.

6. The Contractor shall respond in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
7. The CA retains the original non-conformance forms until the end of the project.
8. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the A/E. In such case, the Contractor shall provide the A/E with the following:

   a. Within one week of notification from the A/E, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the A/E within two weeks of the original notice.
   b. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
   c. The A/E will determine whether a replacement of all identical units or a repair is acceptable.

d. Two examples of the proposed solution will be installed by the Contractor and the CA will test the installations for up to one week, upon which the A/E will decide whether to accept the solution. The Contractor will be responsible for the cost of such testing.
e. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA, if necessary. The CA recommends acceptance of each test to the A/E using a standard form. The A/E gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.8. OPERATION AND MAINTENANCE MANUALS

A. Standard O&M Manuals.

1. The specific content and format requirements for the standard O&M manuals are detailed in Section 017823. Special requirements for the controls contractor and TAB contractor are found Section 230800

2. CA Review and Approval. Prior to substantial completion, the CA shall review the O&M manuals, documentation and redline as-builds *for systems that were commissioned* and to verify compliance with the *Specifications.* The CA will communicate deficiencies in the manuals to the, PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the PM or A/E. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

B. Commissioning Record in O&M Manuals.

1. The CA is responsible to compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the Contractor, to be included with the O&M manuals. Three copies of the manuals will be provided. The format of the manuals shall be:

Tab I-1 Commissioning Plan
Tab I-2 Final Commissioning Report (see (B.2) below)
Tab 01 System Type 1 (chiller system, packaged unit, boiler system, etc.)
Sub-Tab A Design narrative and criteria, sequences, approvals for Equipment 1

Sub-Tab B Startup plan and report, approvals, corrections, blank prefunctional checklists

Colored Separator Sheets—for each equipment type (fans, pumps, chiller, etc.)

Sub-Tab C Functional tests (completed), trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms and a recommended recommissioning schedule.

Tab 02 System Type 2.....repeat as per System 1

2. Final Report Details. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance and efficiency, 4) Equipment documentation and design intent, and 5) Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

3. Other documentation will be retained by the CA.

3.9 TRAINING OF OWNER PERSONNEL

A. The Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.

1. The CA shall interview the facility manager and lead engineer to determine the special needs and areas where training will be most valuable. The Owner and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Subs and vendors who have training responsibilities.
2. In addition to these general requirements, the specific training requirements of Owner personnel by Subs and vendors is specified in Divisions 23 and 26. .
3. Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:
   a. Equipment (included in training)
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training on each subject
   g. Instructor for each subject
   h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
   i. Instructor and qualifications
4. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
5. The CA develops an overall training plan and coordinates and schedules, with the Contractor, the overall training for the commissioned systems. The CA develops criteria for determining

that the training was satisfactorily completed, including attending some of the training, etc. The CA recommends approval of the training to the A/E using a standard form. The PM also signs the approval form.

6. At one of the training sessions, the CA will give a presentation discussing the use of the blank functional test forms for re-commissioning equipment.
7. Video taping of the training sessions will be provided by the CA with tapes cataloged by the CA and added to the O&M manuals.
8. The mechanical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall include a review of all systems using the simplified system schematics (one-line drawings).

3.10 DEFERRED TESTING

A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the A/E. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) of heating or refrigeration equipment shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made.

3.11 WRITTEN WORK PRODUCTS

A. The commissioning process generates a number of written work products described in various parts of the *Specifications*. The *Commissioning Plan—Construction Phase,* lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

Product	Developed By
1. Final commissioning plan	CA
2. Meeting minutes	CA
3. Commissioning schedules	CA with Contractor
4. Equipment documentation submittals	Subs
5. Sequence clarifications	Subs and A/E as needed
6. Prefunctional checklists	CA (already in Specs)
Product	**Developed By**
7. Startup and initial checkout plan	Subs and CA (compilation of existing documents)
8. Startup and initial checkout forms filled out	Subs
9. Final TAB report	TAB
10. Issues log (deficiencies)	CA
11. Commissioning Progress Record	CA
12. Deficiency reports	CA

13.	Functional test forms	CA
14.	Commissioning Specifications	CA
15.	Filled out functional tests	CA
16.	O&M manuals	Subs
17.	Commissioning record book	CA
18.	Overall training plan	CA
19.	Specific training agendas	Subs
20.	Final commissioning report	CA
21.	Misc. approvals	CA

END OF COMMISSIONING REQUIREMENTS

SECTION 23 0500
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide basic mechanical materials and methods in accordance with the Contract Documents. The "General Conditions Governing All Contracts" shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:
   1. HVAC demolition.
   2. Equipment installation requirements common to equipment sections.
   3. Painting and finishing.
   4. Concrete bases.
   5. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 - EXECUTION

2.1 HVAC DEMOLITION

A. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   2. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

2.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

2.3 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

2.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

2.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

2.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 23 0519
METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide meter and gages for HVAC piping in accordance with the Contract Documents. The "General Conditions Governing All Contracts" shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.

1.2 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flo Fab Inc.
2. Miljoco Corporation.
3. Palmer Wahl Instrumentation Group.
4. Tel-Tru Manufacturing Company.
5. Trerice, H. O. Co.
6. Weiss Instruments, Inc.
7. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Cast aluminum; 9-inch (229-mm) nominal size unless otherwise indicated.

D. Case Form: Adjustable angle unless otherwise indicated

E. Glass with magnifying lens and blue or red organic liquid.

F. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).

G. Window: Glass.

H. Stem: Aluminum and of length to suit installation.

1. Design for Air-Duct Installation: With ventilated shroud.
2. Design for Thermowell Installation: Bare stem.

I. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.

J. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.3 THERMOWELLS

A. Standard: ASME B40.200.

B. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

C. Material for Use with Copper Tubing: CNR.

D. Material for Use with Steel Piping: CRES.

E. Type: Stepped shank unless straight or tapered shank is indicated.

F. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.

G. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.

H. Bore: Diameter required to match thermometer bulb or stem.

I. Insertion Length: Length required to match thermometer bulb or stem.

J. Lagging Extension: Include on thermowells for insulated piping and tubing.

K. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

L. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 DIRECT-MOUNTED, METAL-CASE, DIAL-TYPE PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Inc.
3. Ernst Flow Industries.
4. Flo Fab Inc.
5. Marsh Bellofram.
6. Miljoco Corporation.
7. Noshok.
8. Palmer Wahl Instrumentation Group.
9. REOTEMP Instrument Corporation.

10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
13. Weiss Instruments, Inc.
14. WIKA Instrument Corporation - USA.
15. Winters Instruments - U.S.

B. Standard: ASME B40.100.

C. Case: Sealed type; cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.

D. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.

E. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

F. Movement: Mechanical, with link to pressure element and connection to pointer.

G. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).

H. Pointer: Dark-colored metal.

I. Window: Glass.

J. Ring: Metal, brass, or stainless steel.

K. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Siphons: Loop-shaped section of brass or stainless-steel pipe with NPS 1/4 or NPS 1/2 (DN 8 or DN 15) pipe threads.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F (minus 7 to plus 93 deg C) shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F (minus 35 to plus 136 deg C) shall be EPDM.

E. Test Kit: Furnish one test kit containing one pressure gage and adaptor, one thermometer, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be 0 to 200 psig (0 to 1380 kPa).
2. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F (minus 18 to plus 104 deg C).
3. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve in piping for each pressure gage for fluids (except steam).

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install test plugs in piping tees.

M. Install liquid-in-glass thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic coil in air-handling units.
3. Outside-, return-, supply-, and mixed-air ducts.

N. Provide the following temperature ranges for thermometers:

1. Heating Hot Water: 0 to 250 deg F (0 to 150 deg C).
2. Condenser Water: 0 to 150 deg F (Minus 20 to plus 70 deg C).
3. Chilled Water: 0 to 150 deg F (Minus 20 to plus 70 deg C).
4. Air Ducts: Minus 40 to plus 110 deg F (Minus 40 to plus 45 deg C).

O. Install dial-type pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Suction and discharge of each pump.

P. Provide the following scale ranges for pressure gages:

1. Heating Hot Water: 0 to 100 psi (0 to 600 kPa).

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION

SECTION 23 0523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide general- duty valves for HVAC piping in accordance with the Contract Documents. The “General Conditions Governing All Contracts” shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1. Bronze ball valves.
2. Iron, single-flange lug-style butterfly valves.
3. High-performance butterfly valves.
4. Bronze swing check valves.
5. Iron swing check valves.
6. Bronze gate valves.
7. Iron gate valves.
8. Bronze globe valves.
9. Iron globe valves.

B. Related Sections:

1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.3 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
4. Locking Lever Handle: For butterfly valves NPS 6 (DN 150) and smaller.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corporation.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 IRON, SINGLE-FLANGE LUG-STYLE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Lug-Style Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Cooper Cameron Valves; a division of Cooper Cameron Corp.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Lug-Style Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Cooper Cameron Valves; a division of Cooper Cameron Corp.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.

e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

C. 200 CWP, Iron, Single-Flange Lug-Style Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Cooper Cameron Valves; a division of Cooper Cameron Corp.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. Mueller Steam Specialty; a division of SPX Corporation.
i. NIBCO INC.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

D. 200 CWP, Iron, Single-Flange Lug-Style Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Cooper Cameron Valves; a division of Cooper Cameron Corp.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. Mueller Steam Specialty; a division of SPX Corporation.
i. NIBCO INC.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.4 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Cameron Valves; a division of Cooper Cameron Corp.
b. Crane Co.; Crane Valve Group; Flowseal.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Jamesbury; a subsidiary of Metso Automation.
f. Milwaukee Valve Company.
g. NIBCO INC.

2. Description:

a. Standard: MSS SP-68.
b. CWP Rating: 285 psig (1965 kPa) at 100 deg F (38 deg C).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
e. Seat: Reinforced PTFE or metal.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Carbon steel.
h. Service: Bidirectional.

B. Class 300, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cooper Cameron Valves; a division of Cooper Cameron Corp.
    b. Crane Co.; Crane Valve Group; Flowseal.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Jamesbury; a subsidiary of Metso Automation.
    f. Milwaukee Valve Company.
    g. NIBCO INC.

2. Description:

    a. Standard: MSS SP-68.
    b. CWP Rating: 720 psig (4965 kPa) at 100 deg F (38 deg C).
    c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    d. Body Material: Carbon steel, cast iron, or ductile iron.
    e. Seat: Reinforced PTFE or metal.
    f. Stem: Stainless steel; offset from seat plane.
    g. Disc: Carbon steel.
    h. Service: Bidirectional.

2.5 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 4.
    b. CWP Rating: 300 psig (2070 kPa).
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: PTFE or TFE.

2.6 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Kitz Corporation.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Powell Valves.
    i. Red-White Valve Corporation.
    j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-71, Type I.
    b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
    c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
    d. Body Design: Clear or full waterway.
    e. Body Material: ASTM A 126, gray iron with bolted bonnet.
    f. Ends: Flanged.
    g. Trim: Bronze.
    h. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

    a. Standard: MSS SP-71, Type I.
    b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
    c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
    d. Body Design: Clear or full waterway.
    e. Body Material: ASTM A 126, gray iron with bolted bonnet.
    f. Ends: Flanged.
    g. Trim: Composition.
    h. Seat Ring: Bronze.
    i. Disc Holder: Bronze.
    j. Disc: PTFE or TFE.
    k. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

2.7 BRONZE GATE VALVES

A. Class 150, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.8 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Kitz Corporation.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Powell Valves.
    i. Red-White Valve Corporation.
    j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
    c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Bronze.
    g. Disc: Solid wedge.
    h. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Powell Valves.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
    c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Bronze.
    g. Disc: Solid wedge.
    h. Packing and Gasket: Asbestos free.

2.9 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Kitz Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.10 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Powell Valves.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.

e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service except Steam: Ball, butterfly, or globe valves.
4. Throttling Service, Steam: Butterfly or globe valves.
5. Pump-Discharge Check Valves:

a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with nonmetallic disc.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 VALVE APPLICATIONS

A. Heating-Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
5. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Lug Style 150-psig (1035-kPa) CWP rating, ferrous alloy, with EPDM liner.
6. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.

8. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Dual-plate, wafer, Class 125 or 150 ferrous alloy.
9. Gate Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
10. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, OS&Y, bronze-mounted cast iron.
11. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
12. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

B. Chilled-Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
5. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Lug Style 150-psig (1035-kPa) CWP rating, ferrous alloy, with EPDM liner.
6. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
8. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Dual-plate, wafer, Class 125 or 150 ferrous alloy.
9. Gate Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
10. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, OS&Y, bronze-mounted cast iron.
11. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
12. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

C. Low-Pressure Steam Piping: Use the following types of valves:

1. Angle Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 (DN 50) and Smaller: Three-piece, 600-psig (4140-kPa) CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
5. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
6. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
7. Gate Valves, NPS 2 (DN 50) and Smaller: Type 3, Class 150, bronze.
8. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, OS&Y, bronze-mounted cast iron.
9. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
10. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

D. Steam Condensate Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: Three-piece, 600-psig (4140-kPa) CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
3. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 200, bronze.
4. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
5. Gate Valves, NPS 2 (DN 50) and Smaller: Type 3, Class 200, bronze.

6. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, OS&Y, bronze-mounted cast iron.
7. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 200, bronze.
8. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.
9. Plug Valves, NPS 2 (DN 50) and Larger: Class 125 or 150, lubricated-type, cast iron.

END OF SECTION

SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections:

1. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 3113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc or Hot-dipped galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International; a subsidiary of Mueller Water Products Inc.
    b. Empire Industries, Inc.
    c. ERICO International Corporation.
    d. Haydon Corporation; H-Strut Division.
    e. NIBCO INC.
    f. PHD Manufacturing, Inc.
    g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 0548
VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide vibration controls for HVAC piping and equipment in accordance with the Contract Documents. The “General Conditions Governing All Contracts” shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1. Isolation pads.
2. Isolation mounts.
3. Freestanding spring isolators.
4. Elastomeric hangers.
5. Spring hangers.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Shop Drawings: Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

C. Welding certificates.

D. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

A. Delegated-Design Submittal:

1. For each wind-load protection device, that is required by this Section or is indicated on Drawings, submit the following:

a. Wind-Load Restraint, and Vibration Isolation Base Selection: Select vibration isolators, wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.

b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
c. Concrete Anchors and Inserts: Include calculations showing anticipated seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
f. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.
g. Qualified Professional Engineer: All designated-design submittals for seismic- and wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.

2. Wind Restraint Detail Drawing:

a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
d. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.

3. All delegated-design submittals for wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.
4. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.
5. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.

2.2 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. Isolation Technology, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene or rubber.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

E. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

F. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

3.3 VIBRATION-CONTROL DEVICE INSTALLATION

A. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

B. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the Commissioner if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Measure isolator deflection.
2. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust active height of spring isolators.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black

C. Background Color: White

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction. Duct service identification shall include air handler or fan that ducts are connected to and whether supply, return, etc.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 incheshigh.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Refrigeration Piping:

a. Background Color: Green
b. Letter Color: White

3.4 DUCT LABEL INSTALLATION

A. Locate stencils near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide testing, adjusting, and balancing for HVAC in accordance with the Contract Documents. The “General Conditions Governing All Contracts” shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1. Balancing Air Systems:

a. Constant-volume air systems.

b. Variable volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.

5. Dates of calibration.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by either AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by either AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by either AABC or NEBB as a TAB technician.

B. TAB Conference: Meet with Engineer, Construction Manager and Commissioning Authority on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.
b. The Contract Documents examination report.
c. TAB plan.
d. Work schedule and Project-site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

G. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 COORDINATION

A. Notice: Provide **seven** days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.8 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent .
2. Air Outlets and Inlets: Plus or minus 5 percent
3. Heating-Water Flow Rate: Plus or minus 5 percent
4. Cooling-Water Flow Rate: Plus or minus 5 percent .

3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing Commissioner.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Commissioner’s name and address.
6. Commissioner name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.

f. Inlet vane settings for variable-air-volume systems.
g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches (mm), and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Preheat-coil static-pressure differential in inches wg (Pa).
g. Cooling-coil static-pressure differential in inches wg (Pa).
h. Heating-coil static-pressure differential in inches wg (Pa).
i. Outdoor airflow in cfm (L/s).
j. Return airflow in cfm (L/s).

k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Entering-water temperature in deg F (deg C).
k. Leaving-water temperature in deg F (deg C).
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig (kPa).
n. Refrigerant suction temperature in deg F (deg C).
o. Inlet steam pressure in psig (kPa).

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated air flow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual air flow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

I. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft. (sq. m).

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Air velocity in fpm (m/s).
c. Preliminary air flow rate as needed in cfm (L/s).

d. Preliminary velocity as needed in fpm (m/s).
e. Final air flow rate in cfm (L/s).
f. Final velocity in fpm (m/s).
g. Space temperature in deg F (deg C).

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Entering-water temperature in deg F (deg C).
c. Leaving-water temperature in deg F (deg C).
d. Water pressure drop in feet of head or psig (kPa).
e. Entering-air temperature in deg F (deg C).
f. Leaving-air temperature in deg F (deg C).

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Commissioning Contractor.
2. The TAB contractor's test and balance Commissioner shall conduct the inspection in the presence of Commissioning Contractor.
3. Commissioning Contractor shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 0715
HVAC DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 23 0716 "HVAC Equipment Insulation."
2. Section 23 0719 "HVAC Piping Insulation."
3. Section 23 3113 "Metal Ducts" for duct liners.

1.2 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. FSP: Foil, scrim, polyethylene.

D. PVDC: Polyvinylidene chloride.

E. SSL: Self-sealing lap.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Attachment and covering of heat tracing inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties, equipment connections, and access panels.
6. Application of field-applied jackets.
7. Application at linkages of control devices.
8. Field application for each equipment type.

C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control inspection reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000-Degree Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ or ASJ-SSL. Factory -applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

J. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Knauf Insulation; Permawick Pipe Insulation.
    b. Owens Corning; VaporWick Pipe Insulation.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-97.
    b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
    c. Marathon Industries, Inc.; 290.
    d. Mon-Eco Industries, Inc.; 22-30.
    e. Vimasco Corporation; 760.

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Aeroflex USA Inc.; Aeroseal.
    b. Armacell LCC; 520 Adhesive.
    c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Red Devil, Inc.; Celulon Ultra Clear.
e. Speedline Corporation; Speedline Vinyl Adhesive.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; Encacel.
   b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
   c. Marathon Industries, Inc.; 570.
   d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-10.
   b. Foster Products Corporation, H. B. Fuller Company; 35-00.
   c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
   d. Marathon Industries, Inc.; 550.
   e. Mon-Eco Industries, Inc.; 55-50.
   f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products, Division of ITW; CP-52.
   b. Foster Products Corporation, H. B. Fuller Company; 81-42.
   c. Marathon Industries, Inc.; 130.
   d. Mon-Eco Industries, Inc.; 11-30.
   e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).

4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
6. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Products: Subject to compliance with requirements, provide the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

8. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

1. Products: Subject to compliance with requirements, provide the following:

    a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto PVC Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    b. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
    c. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
    d. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

    a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    b. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
    c. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
    d. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.

6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Chemical Company (The), Saran 540 Vapor Retarder Film.

F. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
   b. Compac Corp.; 130.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
   d. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:

   a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches (75 mm).
3. Film Thickness: 4 mils (0.10 mm).
4. Adhesive Thickness: 1.5 mils (0.04 mm).
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) or 3/4 inch (19 mm) wide with wing or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) or 3/4 inch (19 mm) wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [0.106-inch- (2.6-mm-)] [0.135-inch- (3.5-mm-)] diameter shank, length to suit depth of insulation indicated.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) AGM Industries, Inc.; CWP-1.
        2) GEMCO; CD.
        3) Midwest Fasteners, Inc.; CD.
        4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [0.106-inch- (2.6-mm-)] [0.135-inch- (3.5-mm-)] diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) AGM Industries, Inc.; CWP-1.
        2) GEMCO; Cupped Head Weld Pin.
        3) Midwest Fasteners, Inc.; Cupped Head.
        4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
        2) GEMCO; Perforated Base.
        3) Midwest Fasteners, Inc.; Spindle.

    b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
    c. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
    d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) GEMCO; Nylon Hangers.
      2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
   c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
      2) GEMCO; Press and Peel.
      3) Midwest Fasteners, Inc.; Self Stick.

   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, or Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.

   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

   a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACS Industries, Inc.
b. C & F Wire.
c. Childers Products.
d. PABCO Metals Corporation.
e. RPR Products, Inc.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) or 4 inches (100 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."

C. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies according to Division 07 Section "Through-Penetration Firestop Systems."

3.5 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by the Commissioner. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, supply-air ducts.
2. Indoor, outdoor-air ducts.
3. Indoor, exhaust-air ducts between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, duct and plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

B. All ductwork within 15 feet of a fan/blower shall be internal lined with 1” thick acoustic duct liner.

3.8 OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Exterior Ductwork: Internally insulate with 1" thick liner and cover with 1.5" rigid board insulation. Alternatively, omit lining and cover with 2" rigid board. Install weatherproof self-stick membrane following installation of insulation.

B. In addition to exterior treatment, all ductwork within 15 feet of a fan/blower shall be internal lined with 1" thick acoustic duct liner.

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide HVAC piping insulation in accordance with the Contract Documents. The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include, but not be limited to, the following:

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.3 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Steam piping, indoors.
2. Steam condensate piping, indoors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Sheet Form Insulation Materials: 12 inches square.
3. Jacket Materials for Pipe: 12 inches long by NPS 2.
4. Sheet Jacket Materials: 12 inches square.

5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by commissioner. Use materials indicated for the completed Work.

1. Piping Mockups:

   a. One 10-foot (3-m) section of NPS 2 (DN 50) straight pipe.
   b. One each of a 90-degree threaded, welded, and flanged elbow.
   c. One each of a threaded, welded, and flanged tee fitting.
   d. One NPS 2 (DN 50) or smaller valve, and one NPS 2-1/2 (DN 65) or larger valve.
   e. Four support hangers including hanger shield and insert.
   f. One threaded strainer and one flanged strainer with removable portion of insulation.
   g. One threaded reducer and one welded reducer.
   h. One pressure temperature tap.
   i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify commissioner seven days in advance of dates and times when mockups will be constructed.
4. Obtain commissioner’s approval of mockups before starting insulation application.

5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless commissioner specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied **FSK jacket** complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products:

a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products:

a. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:]:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements,

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:

a. Dow Corning Corporation; 739, Dow Silicone.

b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.

d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Joint Sealants for Polystyrene Products:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-70.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
6. Color: White or gray.
7. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements,

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.
e.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm (0.013 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

    a. Products: Subject to compliance with requirements,

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

6. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm (0.007 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

    a. Products:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Products:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements,

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch or 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick 3/4 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless .

1. Manufacturers:

a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by commissioner. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by commissioner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Steam piping:

1. NPS 3 inches and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2-1/2 inches thick.

B. Steam Condensate piping:

1. NPS 1.5 inches and and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. None.
2. PVC: 20 mils thick.
3. Aluminum, Smooth : 0.020 inch thick.
4. Painted Aluminum, Smooth: 0.020 inch o r0.024 inch Stainless Steel, Type 304 or Type 316, Smooth 2B Finish.

END OF SECTION

SECTION 23 0993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide sequence of operations for HVAC controls in accordance with the Contract Documents. The "General Conditions Governing All Contracts" shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:
   1. Control sequences for HVAC systems, subsystems, and equipment.

1.2 PACKAGED ROOFTOP UNITS

A. Fan shall run continuously during occupied periods. Outside air damper shall open to minimum position.

B. Energy recovery wheel (if equipped) shall operate according to factory control sequence.

C. During a call for cooling (ie. above 75°F), fan shall run factory and controller shall stage compressors to maintain space temperature setpoint. Hot water control valve shall be closed.

D. During a call for heat (ie. below 68°F),, fan shall run and BAS shall modulate steam control valve to maintain space temperature setpoint.

E. DEMAND CONTROL VENTILATION: When CO2 level in space exceeds setpoint (typ. 800 ppm), BAS shall gradually open outside air damper to bring level below setpoint. When CO2 level is within setpoint for 30 mins (adj.), damper shall gradually close. Exhaust fan/damper shall operate according to factory control sequence.

DCV system shall comply with all Appendix J requirements listed below.

F. ECONOMIZER MODE: During a call for cooling when outdoor air enthalpy is less than return air enthalpy, system shall enter economizer mode. Factory controller shall modulate outdoor air and return dampers to maintain space temperature setpoint. Exhaust air fan/damper shall operate according to factory control sequence.

G. Smoke detected at duct-mounted smoke damper shall stop fan, close OA damper and send alarm signal to fire alarm control panel

H. Activation of Emergency Wall Stop in kitchen area will stop supply fan, close outdoor air damper and send alarm to fire alarm system.

1.3 VRF FAN COIL UNITS AND HEAT PUMPS

A. System shall be capable of heating and cooling. System mode shall automatically change over at individual zone thermostat.

B. During a call for cooling (ie. above 75°F), factory controller shall stage compressors at heat pump to maintain space temperature setpoint.

C. During a call for heat (ie. below 68°F), factory controller shall stage compressors at heat pump to maintain space temperature setpoint.

D. Outdoor heat pump unit compressor shall modulate as required to satisfy heating and/or cooling demands of connected fan coil units. Unit defrost cycle shall operate according to factory sequence.

1.3 DUCT MOUNTED ELECTRIC HEATER

A. Heater shall operate when OA damper is open and blower is running. Heater shall operate to maintain fixed temperature (25 deg F, adj.) observed at duct-mounted sensor.

1.4 VERTICAL UNIT VENTILATORS

A. Unit ventilator evaporator fan shall run continuously in Occupied mode. OA damper shall be open.

B. In Unoccupied mode, fan shall run only as required to maintain Unoccupied heating or cooling setpoint. OA damper shall be closed.

C. During a call for Heat, UV controller shall stage compressor to maintain space temperature setpoint.

D. If heating setpoint cannot be reached after 45 minutes (adj.), BMS shall modulate control valve at hot water coil to maintain space temperature setpoint.

E. During a call for cooling, UV controller shall stage compressor to maintain space temperature setpoint.

F. Economizer shall be enabled when outdoor dry bulb temperature is below 75F and outdoor dewpoint is below 55 deg F. Economizer shall be disabled when outdoor dry bulb temperature is 75 deg F or above OR when outdoor dewpoint is 55 deg F or above.

1.5 EXHAUST FANS

A. Exhaust fan shall run when space temperature is above setpoint. Fan shall stop when space temperature is at or below setpoint.

APPENDIX J - MINIMUM REQUIREMENTS FOR DEMAND CONTROL VENTILATION

a. All air handling equipment are set up and capable of handling the volumetric flow rate of outside air at design day conditions for the maximum occupant load of the space(s) to receive DCV. Volumetric flow rate shall be determined using the "Mechanical Code"

b. Building pressures shall be maintained neutral or slightly positive during all occupied times.

c. Carbon monoxide detector(s) and alarm system are provided in at least one of the occupied spaces served by each indirect fuel fired heating unit to be controlled by DCV.

d. Radon testing during the first heating season, after installation, is required in al areas to receive DCV after installation. Testing will be performed by the District and results will be provided to NYS Department of Health and School District's Health and Safety Committee.

e. Direct digital controls are provided for all control devices serving the air handling systems to be controlled by variable volumetric flow rates of outside air.

REQUIREMENTS FOR DEMAND CONTROL VENTILATION USING SCHEDULED OCCUPANCY

a. Occupancy must be scheduled through building control system. In addition, occupancy may be overridden on by manual control.

b. CO_2 sensor must be provided to monitor occupant load.

c. Record keeping: Records to be provided to School District's Health and Safety Committee.

   1. Space CO_2 concentrations must be recorded at not greater than 15-minute intervals. Records of CO_2 concentrations must be kept for a minimum of three years.

   2. Air flow readings are required in accordance with Indoor Air Quality section of Part III Environment.

REQUIREMENTS FOR DEMAND CONTROL VENTILATION USING CO_2 SENSORS

a. Requirements applicable to all DCV systems shall also apply to those systems using CO_2 sensors.

b. Sensors shall have the following requirements:

1. Sensors must be located at points that are reflective of the breathing zone of each space served.

i. Sensor location(s) must avoid impact of doorways, windows, short circuiting, and supply air vents.

ii. An adequate number of CO_2 sensors have been provided for each space.

2. Sensor quality:

i. Error not to exceed 50 parts per million (ppm) in expected range of measurement.

ii. Drift not to exceed 20 ppm.

3. Redundant CO2 sensors have been provided at each location installed. If the difference in reading between sensors at the same location exceeds ten percent (10%), both sensors will require calibration.

4. Measurement of outside air CO_2 concentrations are not required. An assumed value of 350 ppm may be used in determining ambient CO_2 concentration.

5. Sensors shall take measurements (readings) in each space at intervals not to exceed 1 minute.

c. A minimum volumetric flow of outside air must be provided during occupied times.

1. Minimum flow rate must take into account dilution of non-occupant generated contaminants as well as make-up air requirements of all spaces served by the unit.

END OF SECTION

SECTION 23 1010

UNDERGROUND FUEL TANK SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION/SUMMARY

A. The contractor shall provide one 8'-6" dia. 10,000 gallon, underground tank, double wall, brine filled interstitial space, fiberglass storage tank, manufactured by XERXES, or equal. Tank shall be equipped and installed with new piping, conduit, monitoring equipment, sensors, alarms, and manholes as detailed on drawings and specifications. Reprogramming of the existing Omntec control panel shall be arranged and paid for by the contractor.

B. The Contractor shall furnish the labor, materials, equipment, appliances, services and hauling, and perform operations in connection with the removal, construction and installation of the Work. Work shall be as herein specified and as denoted on the accompanying Drawings.

C. The Owner will provide fuel to fill tanks. Contractor shall notify Owner in advance of setting date of tank for Owner to fill immediately thereafter.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications apply to this Section.

B. Refer to details and schedules on the drawings for additional requirements.

C. Facility Fuel Oil Piping - Section 23 1113

1.03 GOVERNING STANDARDS

A. Underwriters Laboratories Inc. standard 1316, Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures.

B. Underwriters Laboratories of Canada standard ULC-S615, Reinforced Plastic Underground Tanks for Flammable & Combustible Liquids.

C. National Fire Protection Association codes and standards:

D. NFPA 30 Flammable and Combustible Liquids Code

E. NFPA 31 Installation of Oil-Burning Equipment Standard

F. City of New York Department of Buildings M.E.A., 71-85-M

G. American Concrete Institute standard ACI 318, Building Code Requirements for Structural Concrete.

H. All tanks and piping shall be properly installed in accordance with the manufacturer's instructions and either "Petroleum Equipment Institute Recommended Practices for Installation of Underground Liquid Storage Systems" or "American Petroleum Institute Publication Installation of Underground Petroleum Storage Systems."

I. U.L. 971 - Non metallic pipe and U.L. standard 567-89 pipe connections for flammable and combustible LP gas.

J. ASTM Specification A53. Pipe, steel, black and hot-dipped, zinc coated welded and seamless.

K. NYS Mechanical Code for Fuel oil Piping and Storage.

L. NEC (NFPA 70)

1.04 QUALITY ASSURANCE

A. Tanks shall be constructed to meet governing standards with certification plate (UL Label) affixed.

B. Shop Drawings: Contractor shall submit 5 copies of shop drawings for each tank. Drawings shall include all critical dimensions, locations of fittings and accessories, i.e.: spill containment, etc.

C. All tanks equipment and piping materials shall be physically inspected and air tested before being installed. Any defects observed shall be immediately brought to the attention of the Owner. It shall be the sole responsibility of the Contractor to correct any deficiencies, with the manufacturer in strict accordance with manufacturer's recommendations, at no additional cost to the Owner.

D. Contractor shall submit 5 copies of manufacturer's literature including 5 copies of manufacturer's current installation instructions to the Owner.

E. The Contractor shall be a licensed UST installer in the State of New York, during the entire duration of the project. The Contractor shall have the responsibility of notifying and coordinating with all local and state officials. All inspection and registration fees shall be paid by the Owner. The Contractor shall coordinate with the Owner to provide a written site safety plan.

PART 2: PRODUCTS

2.01 FUEL STORAGE TANK

A. FUEL TANK EQUIPMENT SCHEDULE:
   1. UNDERGROUND PIPING
      a. UNDERGTROUND TANK - DWX -8'-6" DIA., 10,000 GALLON DOUBLE-WALL FIBERGLASS BY XERXES
      b. UNDERGROUND PIPING - FRANKLIN FUELING SYSTEMS APT BRAND, F.O.S. AND F.O.R. SHALL BE 2" NON-METALLIC DOUBLE MODEL XP-100-SC
      c. VENT PIPING - 2" NON-METALIC SINGLE WALL, APT MODEL XP-200-D
      d. TANK SUMP ENTRY BOOTS- MFG. BY APT: VENT PIPING FEB-200-D; ELECTRIC CONDUIT FEB-075-D; FOS AND FOR, DDB-100-SC.
      e. PIPE ADAPTERS - MFG. BY APT: MODEL MN-XP-100-100 FOR F.O.S. AND F.O.R.; MODEL MS-XP-200-200 FOR VENT PIPING
      f. SECONDARY CONTAINMENT TEST BOOTS- APT MODEL STB-100
      g. PIPE DUCTING -4"APT MODEL DCT-400
      h. PIPING SUMP -CONTANMENT SOLUTIONS SW-PTS-WT40-(FV X/X/X)-42/8-3 SINGLE WALL ROUND TANK SUMP W/WATERTIGHT LID

B. HARDWARE AND MANHOLES
   1. TANK FILL
      a. SPILL CONTAINER - SHALL BE MFG. BY FRANKLIN FUELING SYSTEMS EBW BRAND MODEL 705-474-65-BLK (with riser cap and adapter)
      b. FILL ADAPTOR - EBW MODEL 778-301-01 OR MORRION BROS. MODEL 305L 0200AA
      c. FILL CAP - EBW MODEL 777-201-02 OR MORRISON BROS. MODEL 305C 0100 AC
      d. OVERFILL PREVENTION VALVE - EBW AUTOLIMITER AUTOMATIC SHUTOFF MODEL 708-491-01

C. MANHOLES
   1. ACCESS MANHOLE/ PIPING SUMP MANHOLE -MORRISON BROS. MODEL 418L-4400 AM
   2. TANK MONITOR MANHOLE(S) - MORRISON BROS. MODEL 418TM 1100AM
   3. LEAK DETECTION -HYRODSTATIC RESERVOIR & BRINE SECONDARY CONTAINMENT MONITORING

D. VALVES AND CAPS
   1. BALL VALES FOR F.O.S. - MORRISON BROS. 1.0" MODEL 691-0500-1V
   2. VENT CAP - 2" UP FLOW VENT CAP EBW MODEL 800-207-02

E. TANK MONITORING SYSTEM
   1. CONTROL PANEL – SEE DRAWING
   2. LEVEL PROBE - OMNTEC MTG 6 (Fuel Oil)
   3. INTERSTITIAL LEAK SENSOR - OMNTEC BX-RES
   4. PIPE SUMP SENSOR -OMNTEC BX-PDS
   5. HIGH LEVEL ALARM - OMNTEC RAS-1-NYS w/ IB-RAS Card for panel

F. BACKFILL & CONCRETE
   1. 3/8" CRUSHED STONE IN ACCORDANCE WITH TANK MFG. REQUIREMENTS
   2. NYSDOT ITEM 304 UNDER CONCRETE SIDEWALK AND TANK COVER PAD

PART 3: EXECUTION

3.01 INSTALLATION OF TANKS

A. The tank must be installed in accordance with all local, state, and federal environmental regulations and safety codes.

B. Tanks must be grounded per local codes,

C. Tanks shall be protected and secured from vandalism. The tank shall also be protected from accidental damage, such as vehicular impacts in accordance with all local applicable codes.

D. Do Not Drop Or Drag The Tanks. Proper lifting equipment shall be supplied by the contractor to properly lift the tanks into place.

E. Tanks shall be carefully handled to prevent damage to the exterior tank coating. The use of the nylon straps is preferred to prevent damage to the tank coating. When using cables, chains, they shall be padded and of adequate length and size.

F. It is the responsibility of the contractor or buyer to touch- up and repair any damage to the coating that occurs during transportation, installation or piping.

G. Installing contractor shall be familiar with all the manufacturers installation and testing procedures.

3.02 PART 4: LIMITED WARRANTY

3.03 LIMITED WARRANTY

A. Warranty shall be Containment Solutions limited warranty in effect at time of delivery.

END OF SECTION

SECTION 23 1113

FACILITY FUEL OIL PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above ground piping and fittings inside building.

B. Above ground flanges and piping components inside building.

C. Pipe hangers and supports.

D. Valves.

1.02 RELATED REQUIREMENTS

A. Section 23 1010 - Fuel Tank System:

1.03 REFERENCE STANDARDS

A. API Spec 5L - Line Pipe; 2012.

B. ASTM A53/A53M ASTM A106 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications; 2013.

D. ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples; 2013.

E. NFPA 30 - Flammable and Combustible Liquids Code; National Fire Protection Association; 2012.

F. NFPA 31 - Standard for the Installation of Oil Burning Equipment; National Fire Protection Association; 2011.

G. UL 1316 - Glass Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Shop Drawings: Indicate tanks, system layout, pipe sizes, location, and elevations. For fuel oil tanks, indicate dimensions and accessories including manholes and hold down straps.

D. Certificates: Certify that products meet or exceed specified requirements.

E. Project Record Documents: Record actual locations of piping system, storage tanks, and system components.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 2 years of experience and approved by manufacturer.

B. Once piping is installed it shall be pressure tested at 1.5 times the working pressure for 24hrs.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. All piping shall be marked per code and ANSI, ASTM and ASME standards

1.07 REGULATORY REQUIREMENTS

A. Conform to NYS Mechanical Code and applicable regulations for installation of fuel oil system.

B. Conform to ASME B31.1 for installation of fuel oil piping.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of fuel oil system.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for defects .

PART 2 PRODUCTS

2.01 PIPING AND FITTINGS INSIDE BUILDING

2.02 3.02

A. Regulatory Requirements:
   1. Comply with the material, fabrication, and operating requirements of ASME B31.3, except as modified herein.
   2. Conform to ASME B31.1 for installation of fuel oil piping.
   3. Conform to applicable regulations for installation of fuel oil system.
   4. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of fuel oil system.
   5. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. Comply with the material, fabrication, and operating requirements of ASME B31.3, except as modified herein.

C. Carbon Steel Pipe:
   1. Comply with One of the Following:
      a. ASTM A53/A53M,ASTM A 106 Type E or S, Grade B, seamless or electric welded, Schedule 80 for pipe less than 2-1/2 inch in diameter or Schedule 40 for pipe 2-1/2 inch in diameter and larger.
      b. API Spec 5L, Product Specification Level (PSL) 1, Grade B, submerged-arc welded or gas metal-arc welded.
   2. End Connections:
      a. Forged, socket weld type, complying with ASTM A182/A182M and ASME B16.11 for pipe or fittings less than 2-1/2 inch.
      b. Buttweld type complying with ASTM A234/A234M, Grade WPB and ASME B16.9 for pipe or fittings 2-1/2 inch and larger of the same wall thickness as the adjoining pipe.
      c. c.

D. Exterior Underground Piping - Refer to Specification Section 23 1010

2.03 FLANGES AND PIPING COMPONENTS

A. Flanges:
   1. Provide flanged end connections on equipment, fittings, piping, piping components, adapters, couplings, and valves complying with ASME 16.5, Class 150.
   2. Carbon Steel: Comply with ASTM A105/A105M.
   3. Gaskets, Non-Isolating:
      a. 1/8 inch thick.
      b. Comply with ASME B16.12, raised-faced type.

c. Material: Buna-N.

4. Gaskets, Electrically Isolating:
   a. Comply with ASTM D229.
   b. Electrical Insulating Material: 1000 ohms resistance.
   c. Chemically compatible with fuel handled.
   d. Full face type.
   e. Provide full surface, spiral-wound, mylar, insulating sleeves between bolts and holes of flanges.
   f. Furnish bolt shank diameter not less than diameter at root of threads.
   g. Provide high-strength 1/8 inch thick, phenolic, insulating washers next to flanges with flat, circular, stainless steel washers over the insulating and under bolt heads and nuts.
   h. Supply adequate bolt length to accommodate insulating gaskets and stainless steel washers.
5. Bolts, Nuts, and Washers:
   a. Comply with ASME B18.2.1 and ASME B18.2.2.
   b. Bolts:
      1) Regular hexagonal type.
      2) Threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes 1 inch and smaller and Eight-Pitch Thread Series for sizes larger than 1 inch.
      3) Provide sufficient length to obtain full bearing on nuts, projecting no more than two full threads beyond nuts with bolts tightened to required torque.
   c. Nuts:
      1) Hexagonal, heavy series type.
      2) Threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes 1 inch and smaller and Eight-Pitch Thread Series for sizes larger than 1 inch.
   d. Carbon Steel Material:
      1) Bolts: Comply with ASTM A307, Grade B, hot-dipped galvanized.
      2) Nuts: Comply with ASTM A563, Grade A, hex style, hot-dipped galvanized.
      3) Washers: Comply with ASTM F844, hot-dipped galvanized.

B. Piping Components:
1. Provide components that meet the material, fabrication, and operating requirements of ASME B31.3, except as modified herein.
2. Pressure Design Class: Class 150 as defined in ASME B16.5.
3. Welded Nipples: Comply with ASTM A733 or ASTM B687 and construct of same material as connecting pipe.
4. Steel Couplings: Comply with API Spec 5L, seamless, extra heavy, wrought steel with recessed ends.
5. Threaded Unions:
   a. Comply with ASME B16.39, Class 150.
   b. Materials: Comply with ASTM A312/A312M, Grade 304 or 316.
   c. Dielectric Unions: Comply with dimensional, strength, and pressure requirements of ASME B16.39, Class 150.
   d. Provide galvanized, plated, or Stainless steel parts.
   e. Furnish water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint and withstand a 600 volt breakdown test when dry.
6. Joint Compound: Resistant to water and suitable for use with fuel containing 40 percent aromatics.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.05 GATE VALVES

A. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder ends.

2.06 BALL VALVES

A. MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, are dry, and have not been over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 PIPING INSTALLATION

A. Install in accordance with manufacturer's instructions and AP1 RP 1615.

B. Route piping in orderly manner and maintain gradient.

C. Group piping whenever practical at common elevations.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Provide clearance for installation of insulation and access to valves and fittings.

END OF SECTION

SECTION 231123

FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Concrete bases.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating Pressure Ratings:

1. Piping and Valves: 125 psig minimum unless otherwise indicated.
2. Service Regulators: 125 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 2 psig.

B. Natural Gas System Pressure within Buildings: 0.5 PSIG but not more than 2 PSIG.

C. Delegated Design: Design restraints and anchors for Natural Gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance

requirements and design criteria indicated, or as approved under requirements of the Fuel Gas Code of this jurisdiction and approving authority.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Steel piping, corrugated stainless steel tubing, associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars.
6. Dielectric fittings.

B. Shop Drawings: For facility Natural Gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.
2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

C. Delegated Design Submittal: For Natural Gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which Natural Gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Qualification Data: For qualified professional engineer.

C. Welding certificates.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing Natural Gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural Gas Service: Do not interrupt Natural Gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of Natural Gas supply according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of Natural Gas service.
2. Do not proceed with interruption of Natural Gas service without Owner's written permission.
3. Notify the “Call Before You Dig” hotline prior to excavation to access existing below grade utility information and location.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.
b. End Connections: Threaded or butt welding to match pipe.
c. Lapped Face: Not permitted underground.
d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory applied, three-layer coating of epoxy, adhesive, and PE.

a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.

b. Steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Steel bolts, washers, and nuts.
e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

B. Corrugated, Stainless steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. OmegaFlex, Inc.
b. Parker Hannifin Corporation; Parflex Division.
c. Titeflex.
d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame Spread Index: 25 or less.
2) Smoke Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating Pressure Rating: 5 PSIG (34.5 kPa).

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless steel tubing with polymer coating.
5. Operating Pressure Rating: 0.5 PSIG - 2.0 PSIG.
6. End Fittings: Zinc coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40/60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

C. Quick Disconnect Devices: Comply with ANSI Z21.41.

1. Copper alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

D. Weatherproof Vent Cap: Cast- or malleable iron increaser fitting with corrosion resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.

2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lee Brass Company.
    b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig (862 kPa).
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for Natural Gas service with "WOG" indicated on valve body.

E. Cast Iron, Non-lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McDonald, A. Y. Mfg. Co.
    b. Mueller Co.; Gas Products Div.
    c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig (862 kPa).

9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for Natural Gas service with "WOG" indicated on valve body.

F. Cast Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. McDonald, A. Y. Mfg. Co.
   d. Milliken Valve Company.
   e. Mueller Co.; Gas Products Div.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig (862 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for Natural Gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Meter Company.
   b. Eclipse Combustion, Inc.
   c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   d. Maxitrol Company.

2. Body and Diaphragm Case: Cast iron or die cast aluminum.
3. Springs: Zink plated steel; interchangeable.
4. Diaphragm Plate: Zink plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.

7. Seal Plug: Ultraviolet stabilized, mineral filled nylon.
8. Single port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field installed, stainless steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 PSIG (13.8 kPa).

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Eaton Corporation; Controls Div.
   b. Maxitrol Company.

2. Body and Diaphragm Case: Die cast aluminum.
3. Springs: Zink plated steel; interchangeable.
4. Diaphragm Plate: Zink plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet stabilized, mineral filled nylon.
7. Factory applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 PSIG (13.8 kPa).

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hart Industries International, Inc.
   b. Jomar International Ltd.
   c. Matco-Norca, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 PSIG (860 kPa) minimum at 180 deg F (82 deg C).
   c. End Connections: Solder joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Matco-Norca, Inc.
    b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    c. Wilkins; a Zurn company.

2. Description:

    a. Standard: ASSE 1079.
    b. Factory-fabricated, bolted, companion-flange assembly.
    c. Pressure Rating: 125 PSIG (860 kPa) minimum at 180 deg F (82 deg C).
    d. End Connections: Solder joint copper alloy and threaded ferrous; threaded Solder joint copper alloy and threaded ferrous.

D. Dielectric Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Description:

    a. Nonconducting materials for field assembly of companion flanges.
    b. Pressure Rating: 150 psig (1035 kPa).
    c. Gasket: Neoprene or phenolic.
    d. Bolt Sleeves: Phenolic or polyethylene.
    e. Washers: Phenolic with steel backing washers.

PART 3 - EXECUTION

3.1 INSTALLATION OF OUTDOOR PIPING

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

C. Install underground, PE, natural-gas piping in accordance with ASTM D2513.

3.2 EXAMINATION

A. Examine roughing-in for Natural Gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.

3.4 INDOOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Locate valves for easy access.

G. Install Natural Gas piping at uniform grade of 2 percent down toward drip and sediment traps.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Verify final equipment locations for roughing-in.

K. Comply with requirements in Sections specifying gas fired appliances and equipment for roughing-in requirements.

L. Drips and Sediment Traps: Install drips at points where condensate may collect, including service meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to allow removal plug or cap.

M. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

O. Concealed Location Installations: Except as specified below, install concealed Natural Gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural Gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install Natural Gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install Natural Gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    a. Exception: Tubing passing through partitions or walls does not require striker barriers.
5. Prohibited Locations:
    a. Do not install Natural Gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install Natural Gas piping in solid walls or partitions.
    c. Do not install Natural Gas piping in egress corridors.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

S. Do not use Natural Gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless steel tubing, corrugated aluminum tubing, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install anode for metallic valves in underground PE piping.

E. Do not install valves in return-air plenums.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for Natural Gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not over tighten.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches ; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

D. Install hangers for horizontal, corrugated stainless steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install Natural Gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in NYS Fuel Gas Code section “401.5 Identification”.

B. Install detectable warning tape directly above underground gas piping 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping is to be the following:

1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.11 PAINTING

A. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior Natural Gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel semigloss or gloss.
d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components with factory applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (low sheen) or (semigloss).
d. Color: Gray.

2. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (flat) or (semigloss).
d. Color: Gray.

D. Damage and Touchup: Repair marred and damaged factory applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 31, "Tests of Piping" Paragraph; and authorities having jurisdiction.

C. Natural Gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.13 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

B. Aboveground Natural Gas piping shall be one of the following:

1. Steel pipe with malleable iron fittings and threaded joints.
2. Steel pipe with wrought steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Aluminum tube with flared fittings and joints.
3. Steel pipe with malleable iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable iron fittings and threaded joints.
2. Steel pipe with wrought steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

D. Containment Conduit Vent Piping: Steel pipe with malleable iron fittings and threaded or wrought steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 2 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Aluminum tube with flared fittings and joints.
3. Steel pipe with malleable iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable iron fittings and threaded joints.
2. Steel pipe with steel welding fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

D. Containment Conduit Vent Piping: Steel pipe with malleable iron fittings and threaded or wrought steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 BELOWGRADE MANUAL GAS SHUTOFF VALVE SCHEDULE

A. See "Underground, Manual Gas Shutoff Valve Schedule" and "Aboveground, Manual Gas Shutoff Valve Schedule" articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
   1. Tamperproof Feature: Locking feature for valves indicated in "Underground, Manual Gas Shutoff Valve Schedule" articles.

3.17 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

   1. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

   1. Bronze plug valve.
   2. Cast Iron, non-lubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

   1. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:

   1. Bronze plug valve.
   2. Cast Iron, non-lubricated plug valve.

E. Valves in branch piping for single appliance shall be of the following:

   1. Bronze plug valve.

END OF SECTION 231123

SECTION 232113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide hydronic piping in accordance with the Contract Documents. The “General Conditions Governing All Contracts” shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1 Pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

a. Hot-water heating piping.
b. Condenser water piping.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.2 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Chilled water Piping: 150 psig at 60 deg F.

1.4 SUBMITTALS

A. Product Data: For each type of the following:

1. Manufactured, preinsulated, cased piping systems. Include carrier piping, insulation type and k-value, jacket, end seals, and major components for each cased piping system.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
3. Air control devices.
4. Chemical treatment.
5. Hydronic specialties.

B. Shop Drawings: Detail the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the

building structure. Detail location of anchors, supports, alignment guides, and expansion joints and loops.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

C. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

D. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150 minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Calpico, Inc.
    b. Lochinvar Corporation.

2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F .

G. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "HVAC Instrumentation and Controls."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bell & Gossett Domestic Pump; a division of ITT Industries.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig .
10. Maximum Operating Temperature: 250 deg F .

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bell & Gossett Domestic Pump; a division of ITT Industries.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Amtrol, Inc.
    b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    c. Conbraco Industries, Inc.
    d. Spence Engineering Company, Inc.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: Bronze or brass, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Amtrol, Inc.
    b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    c. Conbraco Industries, Inc.
    d. Spence Engineering Company, Inc.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.

5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bell & Gossett Domestic Pump; a division of ITT Industries.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8 .
6. CWP Rating: 150 psig .
7. Maximum Operating Temperature: 225 deg F .

2.7 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain water characteristics recommended by heat exchanger manufacturer.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot water heating piping, aboveground, NPS 2 and smaller, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Hot water heating piping, aboveground, NPS 2-1/2 and larger, shall be the following:

1. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Condenser water piping, aboveground, NPS 2-1/2" and smaller, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Condenser water piping, aboveground, NPS 3" and larger, shall be the following:

1. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install triple-duty valves at each pump discharge to balance flow and control flow direction.

E. Install check valves at each pump discharge and elsewhere as required to control flow direction.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

K. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

L. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

M. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

N. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

O. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

S. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Basic Mechanical Materials and Methods."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Basic Mechanical Materials and Methods."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Basic Mechanical Materials and Methods."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 : Maximum span, 7 feet ; minimum rod size, 1/4 inch .
2. NPS 1 : Maximum span, 7 feet ; minimum rod size, 1/4 inch .
3. NPS 1-1/2 : Maximum span, 9 feet ; minimum rod size, 3/8 inch .
4. NPS 2 : Maximum span, 10 feet ; minimum rod size, 3/8 inch.
5. NPS 2-1/2 : Maximum span, 11 feet ; minimum rod size, 3/8 inch .
6. NPS 3 : Maximum span, 12 feet ; minimum rod size, 3/8 inch .
7. NPS 4 : Maximum span, 14 feet ; minimum rod size, 1/2 inch .
8. NPS 6 : Maximum span, 17 feet ; minimum rod size, 1/2 inch .

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 : Maximum span, 5 feet ; minimum rod size, 1/4 inch .
2. NPS 1 : Maximum span, 6 feet ; minimum rod size, 1/4 inch .
3. NPS 1-1/2 : Maximum span, 8 feet ; minimum rod size, 3/8 inch .
4. NPS 2 : Maximum span, 8 feet ; minimum rod size, 3/8 inch .
5. NPS 2-1/2 : Maximum span, 9 feet ; minimum rod size, 3/8 inch .
6. NPS 3 : Maximum span, 10 feet ; minimum rod size, 3/8 inch .

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install bypass chemical feeders in each hydronic system, in upright position with top of funnel not more than 48 inches (1200 mm) above the floor. Install feeder in minimum NPS 3/4 (DN 20) bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 (DN 20) pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

3.7 EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect manual air vents at high points of system and determine if all are installed and bleed air completely.
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers and heat pumps, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232114 - HYDRONIC PIPING (NON METALLIC)

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide hydronic piping in accordance with the Contract Documents. The "General Conditions Governing All Contracts" shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1 Pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

a. Condenser water piping (3" and larger).

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.2 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
1. Condenser water piping, 150 psig at 105 deg F.

1.4 SUBMITTALS

A. Product Data: For each type of the following:

1. Manufactured, preinsulated, cased piping systems. Include carrier piping, insulation type and k-value, jacket, end seals, and major components for each cased piping system.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
3. Air control devices.
4. Chemical treatment.
5. Hydronic specialties.

B. Shop Drawings: Detail the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, supports, alignment guides, and expansion joints and loops.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.7 QUALITY ASSURANCE

A. Material shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

B. Material shall comply with manufacturer’s specifications.

C. Special Engineered products shall be certified by NSF International as complying with NSF 14.

D. Piping Installers: Installers of Aquatherm piping shall be certified by manufacturer of pipes and fittings as having been trained and qualified to join polypropylene piping using fusion welding of the same type as specified in Drawings (socket, butt, electrofusion, fusion outlet).

1.8 DELIVERY STORAGE AND HANDLING

A. Inspect the pipe upon receipt to ensure that it has not been damaged during shipping.

B. Damaged pipe should be cataloged and returned for replacement following distributor's procedures for returns.

C. Protect piping, valves, fittings, etc. before installation in accordance with manufacturer's written instructions.

D. Always store the pipe on a flat surface. When storing the pipe on racks or supports on the ground always have at least four supports, evenly spaced, under a 19-ft length. Place plywood on top of the supports to prevent warping.

E. Piping shall be shipped from the factory with capped ends and stored on supports off the ground with ends covered at all times to prevent nesting of insects, birds, and other animals. Any pipe found to be without end-caps or not raised off of the ground should be cleaned by the contractor prior to installation.

F.Protect piping from accumulation of dirt and debris in and around piping/components.

G. If the pipe is removed from its bag, or the bag has been damaged do not store the pipe unprotected from UV rays (sunlight) for longer than six months. Pipe that is exposed to direct sunlight for longer than six months will not be covered under the warranty.

H. Never place the forks of a forklift into the ends of the pipe. The interior of the pipe may be damaged and can cause it to crack. Handlers may use a padded rug ram inside the pipe or use a crane or lift to handle larger pipe.

I. In cold weather, take extra care when handling the pipe. Cold temperatures reduce the pipe's flexibility, making it more susceptible to impact damage.

PART 2 - PRODUCTS

2.1 PIPE AND PIPING PRODUCTS

A. Pipe shall be manufactured from a PP-R or PP-RP(RCT) resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Hydronic hot water and heating piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. All pipe shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

B. Pipe shall be Aquatherm® Green Pipe® MF®, Blue Pipe® MF®, or Blue Pipe® MF® RP(RCT®) available from Aquatherm, NA. Piping specifications and ordering information are available at www.aquatherm.com.

2.2 FITTINGS

A. Fittings shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

B. Fittings shall be Aquatherm® Green Pipe® MF®, Blue Pipe® MF®, or Blue Pipe® MF® RP(RCT®) available from Aquatherm, NA. Fittings specifications and ordering information are available at www.aquatherm.com.

2.3 WARRANTY

A. Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or manufacturing.

A. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

B. Warranty shall be in effect only upon submission by the contractor to the manufacturer valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

C. Installers shall be trained and certified to install the pipe according to the manufacturer's guidelines. Contact your local Aquatherm representative for training.

E. Warranty shall be extended to prefabricated parts constructed by the manufacturer.

2.4 POLYPROPYLENE VALVES

A. Polypropylene Valves shall be manufactured in accordance with the manufacturer's specifications and shall comply with the performance requirements of ASTM F 2389 or CSA B137.11. The valves shall contain no rework or recycled thermoplastic materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.

B. Polypropylene Valves shall be Aquatherm® available from Aquatherm, NA. Valve specifications and ordering information are available at www.aquatherm.com.

2.5 SMOKE AND FIRE RATINGS

A. Where indicated on the drawings that a Plenum-rated Piping System is needed, the pipe shall be wrapped and/or insulated with standard fiberglass or mineral wool pipe insulation, field installed, with bare fittings no closer than every 6 ft. of pipe. The pipe wrap or insulation as a system shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50.

2.6 UV PROTECTION

A. Where indicated on the drawings that the pipe will be exposed to direct UV light for more than 30 days, it shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.

A. Note that molded fittings ½" – 4" do not need to have UV protection. Larger molded fittings (6"-10") and segmented fittings will need to be protected from UV.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Installers shall be trained and certified to install the pipe according to the manufacturer's guidelines. Contact your local Aquatherm representative for training.

C. Install listed pipe materials and joining methods below in the following applications:

1. Chilled water, Aboveground: Polypropylene (PP-R) or PP-RP(RCT) piping in SDR 7.4, 9, 11, or 17.6 based on the required minimum pressure rating and use temperature, in accordance with manufacturer's instructions and ASTM F2389.

2. Condenser water, Aboveground: Polypropylene (PP-R) or PP-RP(RCT) piping in SDR 7.4, 9, 11, or 17.6 based on the required minimum pressure rating and use temperature, in accordance with manufacturer's instructions and ASTM F2389.

D. Installation must be accomplished with the proper tools for installing Aquatherm piping following manufacturer's instructions. Installation tools are available from your local Aquatherm representative. Tools may be purchased or rented.

E. Install hydronic piping level and plumb.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

3.2 FUSION WELDING OF JOINTS

A. Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

B. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

C. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer's specifications.

D. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

E. Data Loggers shall be used to log each joint made. Data logger shall record at least the date, time of day and person making each joint. Data logger shall also record the required pressure/leak test for manufacturer's warranty.

3.3 VALVE APPLICATIONS

A. Install gate valves close to the main on each branch and riser serving 2 or more equipment connections and where indicated.

B. Install gate or ball valves on the inlet to each equipment item and elsewhere as indicated.

C. Install drain valve at the base of each riser, at low points of horizontal runs, and where required to drain hydronic piping system.

D. Install swing check valve on the discharge side of each pump and elsewhere as indicated.

E. Install ball valves in each hot-water circulating loop and the discharge side of each pump.

3.4 PIPING INSTALLATIONS

A. Fire stopping shall be provided to both be compatible with the Aquatherm Piping and meet the requirements of ASTM E 814 or ULC S115, "Fire Tests of Through-Penetration Firestops". Pipe insulations or fire resistive coating shall be removed where the pipe passes through a fire stop and, if required by the firestop manufacturer, for 3 inches beyond the firestop outside of the fire barrier.

B. When installed in systems with pumps in excess of 3.0 HP, piping shall be protected from excessive heat generated by operating the pump at shut-off conditions. Where the possibility exists that the pump will operate with no flow, the protection method shall be a temperature relief valve or comparable level of protection, set to a maximum temperature of 185°F.

C. If heat tracing or freeze protection is specified for the piping, it should be installed on the pipe interior or exterior. It must be suitable for use with plastic piping and be self-regulating to ensure that the surface temperature of the pipe and fittings will not exceed 70°C (158°F).

3.4 HANGER AND SUPPORT INSTALLATION

a. Comply with requirements for pipe hanger, support products, and installation in Section "Hangers and Supports for Plumbing Piping and Equipment."

i. Vertical Piping: MSS Type 8 or 42, clamps.
ii. Individual, Straight, Horizontal Piping Runs:

1. Adjustable, steel clevis hangers.
2. Clamps on strut trapeze.
3. Clamps on strut attached to structure.
4. Clamps attached directly to the structure.

iii. Base of Vertical Piping: MSS Type 52, spring hangers.

b. Support vertical piping and tubing at base and 10-ft. intervals or at each floor whichever is less. For piping 2” (63mm) or smaller, install mid-story guides.

c. Install hangers and supports at intervals specified in the applicable Plumbing Code and/or as recommended by pipe manufacturer.

d. Hangers and supports shall also be provided within 1-foot of every change of direction and within 1-foot of any pipe fittings and valves.

e. For hot water piping, provide clamps and supports that are felt or rubber/vinyl coated or lined.

f. For cold water piping supports and clamps may be bare metal. Ensure that the clamp or support does not have sharp edges that may scrape or gouge the piping.

g. Use care when installing riser clamps to not over tighten the clamps to cause indentation of the pipe. Riser clamps shall be isolated from the building structure by placing felt or rubber pads between the clamp, the pipe and the structure.

h. All piping support materials shall be new and manufactured for the specific purpose of supporting systems, equipment, pipes and accessories. No improvised pipe support solutions shall be allowed.

i. Piping systems shall not have direct contact with the building structure. Provide isolation at tub and shower valves and pipes passing through studs, joists or plates. Use

iron pipe sizes to fit Aquatherm pipe. Acceptable manufacturers for pipe/structure isolation:

a. Holdrite
b. Oatey
c. Sioux Chief

3.5 EXPANSION AND CONTRACTION

A. Provide expansion and contraction controls, guides and anchors to take into account the expansion and contraction of the pipe. Provide expansion loops or offsets as required and as indicated in the manufacturer's literature.

i. While Aquatherm® MF® or MF®RCT® (faser) piping can absorb most of their own expansion stresses, this can cause the pipe to bow or bend.
ii. Install anchor points at least every 120 feet.
iii. Install expansion loop or offset between each anchor point. Expansion device must be able to absorb all the stresses between the two anchor points. Refer to manufacturer's published instructions, formulas and calculations at www.aquatherm.com.
iv. Non-MF® pipes used for hot applications shall have expansion controls every 30 feet of straight runs.
v. Vertical risers of MF® or MF®RCT® piping shall be anchored at each floor.
vi. Provide anchor point at branch take-off in vertical riser of MF® or MF®RCT® piping.

3.5 PRESSURE/LEAK TESTING

A. While still accessible all piping shall be pressure/leak tested to the manufacturer's standards.

B. Tests shall be carried out using water, compressed air or a mixture of the two. The test pressure shall be as indicated in the pressure leak testing procedures required by the manufacturer.

C. In the event that water is not available for testing it shall be permissible to use compressed air as a testing medium. Contact the engineering department of the manufacturer for guidance. Follow all precautionary procedures recommended by the piping manufacturer

D Any leaks detected shall be repaired at the contractor's expense by removing the leaking part and replacing with new parts welded per the pipe manufacturer's guidelines. See www.aquatherm.com for additional details and forms.

3.4 INSPECTING AND CLEANING

A. The pipes shall be flushed with cold water after finishing the installation. Flush the system until the water runs clear of debris and dirt.

B. Inspect and test piping systems following procedures of authorities having jurisdiction and as specified by the piping system manufacturer.

C. Clean and disinfect water distribution piping following procedures of the manufacturer and/or the authority having jurisdiction.

3.5 AQUATHERM MAINTENANCE PLAN

A. Aquatherm pipe is pretty much "maintenance free" as an installation goes, but there are few things that need to be observed after installation of the product. Adhering to these points will ensure a long and happy life with Aquatherm pipe.

B. The design and installation of the Aquatherm piping was carried out with anticipated temperatures and pressures. The piping chosen for the project was chosen based on these parameters. If the temperature or pressure of this Aquatherm piping system is required to change, please notify Aquatherm Engineering (engineering@aquatherm.com or call (801)805-6657) to ensure that the proposed changes are within the limits of the installed piping.

C. The design and installation of the Aquatherm piping was carried out with the anticipation that certain chemicals would be in the water or chemicals themselves would be carried directly by the piping. The piping chosen for the project was chosen based on these parameters. If the chemistry of the water or chemical carried by this Aquatherm piping system is required to change, please notify Aquatherm Engineering (engineering@aquatherm.com or call (801)805-6657) to ensure that the proposed changes are within the limits of the installed piping.

D. Aquatherm pipe, copper pipe and domestic hot chlorinated water mixed together in a recirculating system can cause problems. Please note the following parameters if copper piping is to be introduced into the Aquatherm piping system. Please refer to: 201207C – AQTTB - Integration of other systems or components with Aquatherm piping for pressure pipe applications.
    1. Do not mix Aquatherm pipe with other piping systems in conditions that will cause the other system or components to fail.
    2. The temperature of the system must not exceed 140°F
    3. The velocity of the system must be maintained at 3 ft./sec. or slower.
    4. Small amounts of copper or brass in valves and other equipment will generally not cause an issue.
    5. Hydraulically balance a DHWR-system and ensure the required flow rate for each area of the building
    6. Do not add additional chlorine, chloramine, chlorine dioxide, on-site copper ion generation or other disinfectants to the DHWR system without first consulting with Aquatherm's Engineering Department in Lindon Utah at (801)642-4145 or engineering@aquatherm.com
    7. The above guidelines do not apply to hydronic heating systems.

E. If there are flanged connections or butterfly valve connections in the Aquatherm system, please follow the guidelines noted in our technical bulletin 201405B – AQTTB – Flanges and Butterfly Installation Guidelines. Please note that flange bolts and nuts can loosen over time from expansion and contraction and may need to be periodically re-tightened. It is wise to check these connections on a regular basis to ensure that loosening has not occurred.

F. Aquatherm valves are popular valves to use in Aquatherm systems. The following maintenance guidelines need to be observed.
   1. The valve manufacturer recommends that the valve be cleaned periodically depending on external conditions.
   2. Clean only with a damp cloth. Do not use chemicals that will corrode the housing or the seals.
   3. The valve should be checked for functionality (exercised) at least quarterly. The following are suggestions for checking the valve for functionality.
      a. Verify the direction for turning the valve.
      b. Verify that the valve is installed correctly. See Aquatherm Technical Bulletin No.201609A – AQTTB – Aquatherm Polypropylene Valve Installation Notes
      c. Close the valve slowly.
      d. Open the valve slowly
      e. Repeat the open/close cycle at least three (3) times

G. It is recommended that the customer add the Aquatherm piping system and piping equipment into their structured Facility Inspection and Equipment Maintenance Plans

END OF SECTION 232114

SECTION 232116

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Condensate-drain piping.
4. Air-vent piping.
5. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 175 psig at 250 deg F.
2. Makeup-Water Piping: 150 psig) at 120 deg F.
3. Condensate-Drain Piping: 40 deg F.
4. Blowdown-Drain Piping: 200 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Gate, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."Section 15112 "General-Duty Valves for HVAC Piping."

B. Bronze, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump.
c. Flow Design Inc.
d. Gerand Engineering Co.
e. Griswold Controls.
f. Nexus Valve, Inc.
g. Taco.
h. Tour & Andersson; available through Victaulic Company.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.

5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig (860 kPa).
10. Maximum Operating Temperature: 250 deg F (121 deg C).

C. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump.
    c. Flow Design Inc.
    d. Gerand Engineering Co.
    e. Griswold Controls.
    f. Nexus Valve, Inc.
    g. Taco.
    h. Tour & Andersson.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig (860 kPa).
10. Maximum Operating Temperature: 250 deg F (121 deg C).

D. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.

7. Low inlet-pressure check valve.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flow Design Inc.
    b. Griswold Controls.
    c. Nexus Valve, Inc.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 250 deg F.

2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Nexus Valve, Inc.
    e. Taco, Inc.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/8 (DN 6).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Nexus Valve, Inc.
    e. Taco, Inc.

2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2 (DN 15).
6. Discharge Connection: NPS 1/4 (DN 8).
7. CWP Rating: 150 psig (1035 kPa).
8. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. (379-L) unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig (860-kPa) working pressure and 250 deg F (121 deg C) maximum operating temperature.
4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig (860-kPa) working pressure and 240 deg F (116 deg C) maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
5. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- (20-mm-) diameter gage glass, and slotted-metal glass guard.

D. Bladder-Type Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

E. Tangential-Type Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375 deg F (191 deg C) maximum operating temperature.
3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.

4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

F. In-Line Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Products, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Taco, Inc.

2. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
3. Maximum Working Pressure: Up to 175 psig (1207 kPa).
4. Maximum Operating Temperature: Up to 300 deg F (149 deg C).

G. Air Purgers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump.
   d. Taco, Inc.

2. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
3. Maximum Working Pressure: 150 psig (1035 kPa).
4. Maximum Operating Temperature: 250 deg F (121 deg C).

2.4 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig (860 kPa).

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 60 mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (860 kPa).

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
3. CWP Rating: 750 psig (5170 kPa).

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

C. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

D. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116

SECTION 23 2300
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.
3. Shop Drawing Scale: 3/8” equals 1 foot.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-454B:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

G. Copper Pressure-Seal Fitting for Refrigerant Piping:
1. Standard: UL 207; certified by UL for field installation. Certification as a UL-recognized component alone is unacceptable.
2. Housing: Copper.
3. O-Rings: HNBR or compatible with specific refrigerant.
4. Tools: Manufacturer's approved special tools.
5. Minimum Rated Pressure: 700 psig.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:
1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.

7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-454B

A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install packed-angle valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Section 23 0923 "Direct Digital Control (DDC) System for HVAC" and Section 23 0993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 3113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Section 23 0553 "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 0518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic restraints in Section 23 0548 "Vibration and Seismic Controls for HVAC."

B. Comply with Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

F. 58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 3113
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Work Included: Provide metal ducts in accordance with the Contract Documents. The “General Conditions Governing All Contracts” shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
2. Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Duct Construction: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.3 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.

6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Welding certificates.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

2. Duct Size: Maximum 30 inches (750 mm) wide and up to 2-inch wg (500-Pa) pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 LISTED DUCTWORK FOR REMOVAL OF GREASE AND SMOKE LADEN VAPORS

1. Available Manufacturers:

a. Listed Double-Wall Insulated grease duct shall be model IPIC 2G grease duct manufactured by Metal-Fab, Inc

A. The grease duct shall be insulated double-wall factory –built type for use with Type I kitchen hoods, as described in NFPA-96 for the transportation of air and grease-laden vapors from commercial cooking operation.

B. Product Description:
   a. Metal-Fab Series 2G Grease Duct.
   b. Factory prefabricated, double wall type, listed for venting of grease laden air from kitchen hoods requiring grease duct as described in NFPA 96.
   c. Rated for continuous operation at 500° F and intermittent operation at 2000° F.
   d. All components of the grease duct system shall be provided by the manufacturer to ensure the system meets the requirements of the listing including duct supports, guides, fittings, cleanouts, and expansion joints required to install the duct.
   e. Grease duct shall be listed by the following agencies with the associated listed reports:
      i. UL 1978 (File MH8251) - Grease Ducts for Restaurant Cooking Appliances.
      ii. UL103HT (MH8251) - Standard for factory built chimneys and building heating appliances.
      iii. UL2221 (File R 15388) – Condition B – evaluated as an alternative to a 2 hour site-built and chased installation with 3 inches minimum clearance to a fully enclosed combustible construction.
   f. The duct sections shall be constructed of an inner wall and an outer wall with ceramic fiber insulation between the walls.
      i. The inner wall shall be constructed of 304, 316 or 430 stainless steel.
         1. 6 through 36 inch diameter materials: 0.035 inch thick inner wall.
         2. 38 through 48 inch diameter materials: 0.048 inch thick inner wall.
      ii. The outer wall shall be constructed of aluminized steel, 304 or 316 stainless steel.
         1. 6 thru 22 diameter inch materials: 0.024 inch thick outer wall.
         2. 24 thru 48 inch diameter materials: 0.034 thick outer wall.
      iii. The duct shall include a 2" thickness of body soluble ceramic fiber insulation between the inner and outer walls.
   g. The duct wall assembly is Tested and Listed to 1 inch clearance to combustibles for 6 inch to 18 inch diameters, 2 inches clearance to combustibles for 20 to 32 inch diameters, 3 inches clearance to combustibles for 34 to 42 inch diameters, 4 inches clearance to combustibles for 44 to 48 inch diameters.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils (0.10 mm) thick.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
b. Johns Manville.
c. Knauf Insulation.

3. Minimum Thermal Conductivity (R-Value): 5.80.
4. Minimum Thickness: 1 inches.
5. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating.

Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

6. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. VOC: Maximum 395 g/L.
9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
10. Service: Indoor or outdoor.
11. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Fasteners appropriate for construction materials to which hangers are being attached.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.7 DUCT CLEANING

A. Clean new duct systems before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Rectangular Ducts Located in the Basement or in Crawl Spaces: PVC-coated, galvanized sheet steel with thicker coating on duct exterior.

B. Supply Ducts:

1. Pressure Class: Positive 2-inch wg (500 Pa).

C. Return Ducts:

1. Pressure Class: Positive or negative 2-inch wg (500 Pa).

D. Exhaust Ducts:

1. Pressure Class: Negative 2-inch wg (500 Pa).

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

F. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.
2. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.
3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
4. All Air Ducts when no external wrap is present: Fibrous glass, Type I, 1-1/2 inches thick minimum.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Radius-to Diameter Ratio: 1.5.

    b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam or welded.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 3300
DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide duct accessories in accordance with the Contract Documents. The “General Conditions Governing All Contracts” shall apply to all work under the contract. The work of this section shall include, but not be limited to, the following:

1. Manual volume dampers.
2. Control dampers.
3. Fire dampers.
4. Ceiling dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounting access doors.
8. Flexible connectors.
9. Duct accessory hardware.

B. Related Sections include the following:

1. Division 28 Section "Digital, Addressable Fire-Alarm System" for duct-mounting fire and smoke detectors.
2. Division 23 Section "HVAC Instrumentation and Controls" for damper actuators.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Source quality-control reports.

E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

A. Manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.

2. Flexmaster U.S.A., Inc.
3. McGill AirFlow LLC.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Ruskin Company.
7. Trox USA Inc.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Blade Seals: Neoprene.
5. Tie Bars and Brackets: Galvanized steel.

E. Jackshaft: 1-inch diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

A. Manufacturers:
1. Duro Dyne Inc.
2. Flexmaster U.S.A., Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. METALAIRE, Inc.

6. Nailor Industries Inc.
7. Ruskin Company.
8. Vent Products Company, Inc.
9. Young Regulator Company.

B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch- (2.8-mm) thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- (1.61-mm) thick, galvanized-steel damper blades with maximum blade width of 8 inches (203 mm).

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Provide parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg (995 Pa) when damper is being held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.5 FIRE DAMPERS

A. Manufacturers:
1. Cesco Products; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. McGill AirFlow LLC.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. NCA Manufacturing, Inc.
7. Pottorff; a division of PCI Industries, Inc.
8. Ruskin Company.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1-1/2 hours.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F (74 deg C) rated.

2.6 CEILING DAMPERS

A. Manufacturers:
1. Cesco Products; a division of Mestek, Inc.
2. McGill AirFlow LLC.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Ruskin Company.

B. General Description: Labeled according to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Fusible Links: Replaceable, 165 deg F (74 deg C) rated.

2.7 FLANGE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.
d. SEMCO Incorporated.
e. Ward Industries, Inc.; a division of Hart & Cooley, Inc

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:

a. American Warming and Ventilating; a division of Mestek, Inc.
b. Ductmate Industries, Inc.
c. Greenheck Fan Corporation.
d. McGill AirFlow LLC.
e. Nailor Industries Inc.
f. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

a. Less Than 12 Inches Square: Secure with two sash locks.
b. Up to 18 Inches Square: Two hinges and two sash locks.
c. Up to 24 by 48 Inches: Three hinges and two compression latches.
d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Flexmaster U.S.A., Inc.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) or 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick,

galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire dampers according to UL listing.

G. Connect ducts to duct silencers rigidly.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. At outdoor-air intakes and mixed-air plenums.
3. At drain pans and seals.
4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
6. At each change in direction and at maximum 50-foot (15-m) spacing.
7. Upstream or downstream from duct silencers.
8. Control devices requiring inspection.
9. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Install the following minimum sizes for duct-mounting, rectangular access doors:

1. As shown on Mechanical Details of Drawings.
2. One-Hand or Inspection Access: 12 by 12 inches.
3. Two-Hand Access: 12 by 12 inches.
4. Head and Hand Access: 16 by 20 inches.
5. Head and Shoulders Access: 16 by 20 inches.
6. Body Access: 24 by 24 inches.
7. Body Plus Ladder Access: 24 by 24 inches.

K. Install the following minimum sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 12 inches in diameter.
2. Two-Hand Access: 12 inches in diameter.
3. Head and Hand Access: 18 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

N. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect diffusers to ducts directly. Flexible duct is not permitted for this project.

P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 3713
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Work Included: Provide diffusers, registers, and grilles in accordance with the Contract Documents.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Diffusers, registers, and grilles are scheduled on Drawings.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Titus.
2. Price Industries.

2.2 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

SECTION 23 7200
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Packaged energy recovery ventilator (ERV)

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.

   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

   1. Suspended ceiling components.
   2. Structural members to which equipment or suspension systems will be attached.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of each type of filter specified.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ARI Compliance:

1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
2. Capacity ratings for air coils shall comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

C. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

D. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."
2. Electric coils shall comply with requirements in UL 1995, "Heating and Cooling Equipment."

1.8 COORDINATION

A. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Packaged Energy Recovery Units: One years.
2. Warranty Period for Energy Transfer Core: 10 years.

PART 2 - PRODUCTS

2.1 PACKAGED ENERGY RECOVERY VENTILATOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. RenewAire LLC.
   2. Lossnay Corp.
   3. Oxygen 8.

B. Unit Cabinet: Fabricated of galvanized steel, and covered with polyurethane foam insulation as necessary with steel mounting points securely attached.

C. Blowers:
   1. Direct drive centrifugal blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow
   2. The blower motors shall be a directly connected to the blower wheels and have permanently lubricated bearings

D. Heat Exchanger:
   1. The enthalpic heat exchanger element shall be constructed of specially treated cellulous fiber membrane separated by corrugated layers to allow total heat (sensible and latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions.
   2. Heat exchanger does not require condensate drain

E. Bypass Damper:
   1. Automatic supply side by-pass damper to allow inbound ventilation air to by-pass the heat exchanger element when factory-installed thermistors measure outside ambient temperature being at least 7 degrees cooler than air returned from interlocked indoor units running in cooling mode
   2. The mechanism for opening and closing the bypass damper shall be a 208V-230V synchronous electric motor through an actuator. The motor will drive a steel cable connected to a mechanical damper flap to allow fresh air to bypass the element

F. Air Filters: Factory installed, washable air filters located at each intake face (both supply and exhaust sides) of the heat exchanger element

2.2 CONTROLS

A. Independent control by contact closure from other sensor driven controller.

B. Electric-Coils Controls:

   1. Factory-mounted sensor in unit discharge with sensor adjustment located in control panel to control electric coil to maintain temperature.
   2. Wall-mounted, space-temperature sensor with temperature adjustment to control electric coil to maintain temperature.
   3. Coil Controls: Multiple steps.

2.3 CAPACITIES AND CHARACTERISTICS

A. See equipment schedules on drawings for capacities and characteristics

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 237223

PACKAGED, OUTDOOR, HEAT WHEEL ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heat wheels in packaged, outdoor, energy recovery units.

B. Related Requirements:
1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For packaged, outdoor, heat-wheel, energy-recovery units.

1. Include plans, elevations, sections, details, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, lifting requirements, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For packaged, outdoor, heat-wheel, energy-recovery units indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of heat-wheel, energy-recovery equipment.
2. Vibration-Isolation Roof Curb Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include rails and frames for equipment mounting.
3. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration-isolation roof curbs.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, roof plans, elevations, and other details, drawn to scale and coordinated with each other, using input from installers of items involved.

B. Seismic Qualification Data: Certificates, for packaged, outdoor, heat-wheel, energy-recovery units, accessories, and components, from manufacturer.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate sizes and locations of building openings and duct connections with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, outdoor, heat-wheel, energy-recovery units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Packaged Energy-Recovery Units: 3 years from date of Substantial Completion.
2. Warranty Period for Energy-Recovery Wheel: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Provide a product by one of the following listed manufacturers:

A. Trane Company.
B. Carrier Corp.
C. Daikin Corp.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

B. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1.
2. Capacity ratings for heat-wheel, energy-recovery equipment: Comply with ASHRAE 84.

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. UL Compliance:

1. Packaged Heat-Recovery Ventilators: Comply with requirements in UL 1815.

E. Comply with ASTM E84.

F. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration-isolation controls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.3 CAPACITIES AND CHARACTERISTICS

A. Refer to schedule on drawing sheets.

B. Filters:

1. Type: Pleated.
2. Maximum or Rated Face Velocity: 500 fpm.
3. Initial Resistance: 0.15”
4. Recommended Final Resistance: 0.25”

5. Minimum Efficiency Reporting Value:

a. MERV Rating: MERV 13 in accordance with ASHRAE 52.2.

2.4 PACKAGED, OUTDOOR, HEAT-WHEEL, ENERGY-RECOVERY UNITS

A. Source Limitations: Obtain packaged, outdoor, heat-wheel, energy-recovery units from single manufacturer.

B. Surfaces in Contact with Airstream: Comply with requirements in ASHRAE 62.1.

C. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, gasketed hinged access doors with neoprene gaskets for inspection and access to internal parts, minimum 2 inches thick,, thermal insulation, knockouts for electrical connections, exterior drain connection, and lifting lugs.

D. Heat Wheel:

1. Casing:

a. Manufacturer's standard construction with standard factory finish.
b. Slide-in, slide-out cassette style..
c. Provide unit with integral purge section with limited carryover of exhaust air.
d. Provide casing seals on periphery of rotor and on duct divider and purge section.
e. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings with minimum L-50 of 200,000 hours. Support horizontal rotors on tapered roller bearing.

2. Rotor: Aluminum or polymer segmented wheel, strengthened with radial spokes.
3. Rotor: Aluminum or polymer segmented wheel, strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel coating.
4. Rotor: Aluminum, metallic, or polymer segmented wheel, strengthened with radial spokes impregnated with nonmigrating, water-selective, four-angstrom, molecular-sieve desiccant coating.
5. Drive: Electric motor, with speed changed by variable-frequency motor controller and self-adjusting multilink belt around outside of rotor.

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

E. Supply and Exhaust Fans: Centrifugal, forward-curved backward-inclined fan with spring isolators of 1-inch static deflection.

1. Motor and Drive: Direct driven, with speed changed by variable-frequency motor controller.

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
b. Motor Sizes: Minimum size as indicated. If size is not indicated, provide motor large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Filters:

1. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."

G. Filters:

1. Description: pleated, factory-fabricated, self-supported, disposable air filters with holding frames.
2. UL Compliance: Comply with UL 900.
3. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
4. Filter Media Frame: Beverage board with perforated metal retainer or metal grid on outlet side.

5. Filter-Mounting Frames: Arranged with access doors or panels on one or both sides of unit. Design unit with filters removable from one side, or lift out from access plenum.

H. Wiring: Fabricate units with space within housing for electrical conduits. Wire motors and controls, so only external connections are required during installation.

1. Outdoor Enclosure: NEMA 250, Type 3R enclosure contains relays, starters, and terminal strip.
2. Include nonfused disconnect switches.

2.5 CONTROLS

A. Control Panel: Solid-state, programmable, microprocessor-based control unit for wall mounting. Configured for BACnet protocol.

B. Starting relay, factory mounted and wired, and manual motor starter for field wiring.

C. Economizer Control, Stop Wheel: Stop wheel rotation or modulate wheel rotation speed when conditions are favorable for economizer operation.

D. Economizer Control, Airflow Bypass: Heat-wheel airflow bypass. See Section 230923 "Direct Digital Control (DDC) System for HVAC" for control sequence.

E. Enthalpy sensor.

F. Rotation sensor and alarm.

G. Dirty filter switch.

H. Low-Voltage Transformer: Integral transformer to provide control voltage to unit from primary incoming electrical service.

I. Electric Coil Controls:

1. Factory-mounted sensor in outside-air intake with sensor adjustment located in control panel to control electric coil and maintain minimum entering temperature, to avoid frost formation.

J. Variable-Frequency Motor Controller: Comply with Section 262923 "Variable-Frequency Motor Controllers."

K. Variable-Frequency Motor Controller: Serving wheel rotation motor.

1. Manufactured Units: Pulse-width modulated; constant torque for inverter-duty motors.
2. Output Rating: Three phase; 10 to 66 Hz, with torque constant as speed changes; maximum voltage equals input voltage.
3. Unit Operating Requirements:

a. Self-Protection and Reliability Features:

1) Surge suppression.
2) Loss of input signal protection.
3) Under- and overvoltage trips.
4) Variable-frequency motor controller and motor-overload/overtemperature protection.
5) Critical frequency rejection.
6) Loss-of-phase protection.
7) Reverse-phase protection.
8) Motor-overtemperature fault.

b. Bidirectional autospeed search.
c. Across the line Bypass.
d. Motor temperature compensation at slow speeds.

1) Panel-mounted operator station.
2) Historical logging information and displays.
3) Digital indicating devices.

e. Control Signal Interface: Electric.
f. Proportional integral derivative (PID) control interface.
g. DDC System for HVAC Protocols for Network Communications: ASHRAE 135.

4. Line Conditioning:

a. Input line conditioning.
b. Output filtering.
c. EMI/RFI filtering.

L. Variable-Speed Control: Factory mounted and wired, permitting input of field-connected, 4- to 20-mA or 1- to 10-V control signal.

M. Variable-Speed Control: Factory mounted and wired, with exhaust-air sensor to vary rotor speed and maintain exhaust temperature above freezing.

N. Variable-Speed Control: Factory mounted and wired, with exhaust- and outdoor-air sensors, automatic changeover thermostat, and set-point adjuster, to vary rotor speed and maintain air differential temperature above set point. Increase rotor speed to maximum when exhaust-air temperature is less than outdoor-air temperature.

2.6 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended application.

B. AHRI Compliance: Capacity ratings for air-to-air energy-recovery equipment certified as complying with AHRI 1060 (IP).

C. Fan Performance Rating: Comply with AMCA 211, and label fans with AMCA-certified rating seal. Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency in accordance with AMCA 210 and ASHRAE 51.

D. Fan Sound Rating: Comply with AMCA 301 or AHRI 260 (IP).

E. UL Compliance:

1. Packaged Heat-Recovery Ventilators: Comply with requirements in UL 1812.
2. Electric Coils: Comply with UL 1995.

PART 3 - EXECUTION

3.1 INSTALLATION OF PACKAGED, OUTDOOR, HEAT-WHEEL, ENERGY-RECOVERY UNITS

A. Examine casing insulation materials and filter media before packaged, outdoor, heat wheel energy-recovery unit installation. Replace insulation materials and filter media that are wet, moisture damaged, or mold contaminated.

B. Install packaged, outdoor, heat-wheel, energy-recovery units, so supply and exhaust airstreams flow in opposite directions, and rotation is away from exhaust side to purge section to supply side.

1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

C. Equipment Mounting:
1. Install roof-mounted packaged, outdoor, heat-wheel, energy-recovery units on manufacturer's-recommended-height equipment roof curbs. Comply with requirements for equipment curbs specified in Section 077200 "Roof Accessories."
2. Comply with requirements for vibration-isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

D. Install units with clearances for service and maintenance.

E. Do not operate equipment fans until temporary or permanent filters are in place. Replace temporary filters used during construction and testing with new, clean filters prior to final inspection.

3.2 DUCTWORK CONNECTIONS

A. Comply with requirements for ductwork in accordance with Section 233113 "Metal Ducts."

B. Connect duct to units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

C. Isolation Dampers: Install isolation dampers in accordance with Section 230923.12 "Control Dampers."

3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to unit, allow service and maintenance.

C. Connect piping to units mounted on vibration isolators with flexible connectors.

D. Condensate Drain Piping: See Section 232113 "Hydronic Piping" for pipe type. Install condensate drain piping from drain pans to nearest floor drain, same size as condensate drain connection.

1. Construct deep trap at connection to drain pan, and install cleanouts at changes in direction.

3.4 ELECTRICAL CONNECTIONS

A. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Packaged, outdoor, heat-wheel, energy-recovery equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 DEMONSTRATION

A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy-recovery units.

END OF SECTION 237223.23

SECTION 23 7416
PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components:

1. Casings.
2. Fans, drives, and motors.
3. Coils.
4. Refrigerant circuit components.
5. Air filtration.
6. Dampers.
7. Electrical power connections.
8. Controls.
9. Roof curbs.
10. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of RTU.

B. Shop Drawings: For each packaged, large-capacity, rooftop air-conditioning units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Seismic Qualification Data: Certificates, for RTUs, accessories, and components, from manufacturer.

D. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Source quality-control reports.

F. System startup reports.

G. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance: Comply with UL 1995.

G. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.

1. Design RTU supports to comply with [wind] [and] [seismic] performance requirements.

2.2 Evaporator fan compartment:

1. Interior cabinet surfaces shall be insulated with a minimum $^{1}/_{2}$-in. thick, minimum $1^{1}/_{2}$- lb density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.

2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

3. Unit internal insulation linings shall be resistant to mold growth in accordance with “mold growth and humidity” test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the “Erosion Test” in UL 181, as part of ASTM C1071.

2.3 Instrumentation and control devices for HVAC

A. Thermostats

1. Thermostat must

a. energize both “W” and “G” when calling for heat.

b. have capability to energize 2 different stages of cooling, and 2 different stages of heating.

c. include capability for occupancy scheduling.

c.

2.4 Compressor over-temperature, over-current.

2. Low-pressure switch:

a. Units shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.

b. Low pressure switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.

3. High-pressure switch.

a. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.

b. Low pressure switch shall use different color wire than the high-pressure switch. The purpose is to assist the installer and service technician to correctly wire and/or troubleshoot the rooftop unit.

4. Automatic reset, motor thermal overload protector.

2.5 Panel air filters

A. Standard filter section

Shall consist of factory-installed, low velocity, throwaway 2-in. thick fiberglass filters of commercially available sizes.

2. Unit shall use only one filter size. Multiple sizes are not acceptable.

3. Filters shall be accessible through an access panel with "no-tool" removal as described in the unit cabinet section of this specification (23 81 19.13.G).

2.6 Self-contained air conditioners

A. General:

Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing hermetic scroll compressor(s) for cooling duty and gas combustion for heating duty.

2. Factory assembled, single piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.

3. Unit shall use Puron® R-410A refrigerant.

4. Unit shall be installed in accordance with the manufacturer's instructions.

5. Unit must be selected and installed in compliance with local, state, and federal codes.

B. Quality Assurance:

Unit meets ASHRAE 90.1-2016 and IECC[1]-2015 minimum efficiency requirements.

2. Units are Energy Star certified where sizes are required.

3. Unit shall be rated in accordance with AHRI Standard 340/360.

4. Unit shall be designed to conform to ASHRAE 15.

5. Unit shall be ETL-tested and certified in accordance with ANSI Z21.47 Standards and ETL-listed and certified under Canadian standards as a total package for safety requirements.

6. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

7. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.

8. Unit casing shall be capable of withstanding 500 hour salt spray exposure per ASTM B117 (scribed specimen).

9. Roof curb shall be designed to conform to NRCA Standards.

10. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.

11. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.

12. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.

13. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.

14. High-Efficiency Motors listed shall meet section 313 of the Energy Independence and Security Act of 2007 (EISA 2007).

C. Delivery, storage, and handling:

Unit shall be stored and handled per manufacturer's recommendations.

2. Lifted by crane requires either shipping top panel or spreader bars.

3. Unit shall only be stored or positioned in the upright position.

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D. Project conditions:

As specified in the contract.

E. Operating characteristics:

3 Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 340/360 at ± 10% voltage.

2. Compressor with standard controls shall be capable of operation from 35°F (2°C), ambient outdoor temperatures. Accessory kits are necessary if mechanically cooling at ambient temperatures below 35°F (2°C).

3. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.

4. Unit shall be factory configured and ordered for vertical supply and return configurations.

5. Unit shall be factory furnished for either vertical or horizontal configuration without the use of special conversion kits.

6. No field kits conversion is possible.

F. Electrical Requirements:

Main power supply voltage, phase, and frequency must match those required by the manufacturer.

G. Unit Cabinet:

Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a prepainted baked enamel finish on all externally exposed surfaces.

2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F): 60, Hardness: H-2H Pencil hardness.

3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum $^{1}/_{2}$-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.

4. Unit internal insulation linings shall be resistant to mold growth in accordance with “mold growth and humidity” test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the “Erosion Test” in UL 181, as part of ASTM C1071.

5. Base of unit shall have a minimum of four locations for factory thru-the-base electrical connections. Connections shall be internal to the cabinet to protect from environmental issues.

6. Base Rail:

a. Unit shall have base rails on a minimum of 2 sides.

b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.

c. Holes shall be provided in the base rail for moving the rooftop by fork truck.

d. Base rail shall be a minimum of 16 gage thickness.

7. Condensate pan and connections:

a. Shall be a sloped condensate drain pan made of a non-corrosive material.

b. Shall comply with ASHRAE Standard 62.

c. Shall use a $^{3}/_{4}$-in. 14 NPT drain connection at the end of the drain pan. Connection shall be made per manufacturer’s recommendations.

8. Top panel:

a. Shall be a multi-piece top panel linked with water tight flanges and interlocking systems.

9. Electrical Connections:

a. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.

b. Thru-the-base capability:

1) Thru-the-base provisions / connections are available as standard with every unit. When bottom connections are required, field furnished couplings are required.

2) No basepan penetration, other than those authorized by the manufacturer, is permitted.

10. Component access panels (standard):

a. Cabinet panels shall be easily removable for servicing.

b. Unit shall have one factory installed, tool-less, removable, filter access panel.

c. Panels covering control box and filters shall have molded composite handles while the blower access door shall have an integrated flange for easy removal.

d. Handles shall be UV modified, composite, permanently attached, and recessed into the panel.

e. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.

f. Collars shall be removable and easily replaceable using manufacturer recommended parts.

H. Coils:

4 Standard Aluminum Fin/Copper Tube Coils:

a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.

b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.

c. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

2. Optional Pre-coated aluminum-fin condenser coils:

a. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.

b. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.

c. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.

d. Corrosion durability of fin stock shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.

e. Corrosion durability of fin stock shall be confirmed through testing to have no visible corrosion after 48 hour immersion in a room temperature solution of 5% salt, 1% acetic acid.

f. Fin stock coating shall pass 2000 hours of the following: one week exposure in the prohesion chamber followed by one week of accelerated ultraviolet light testing. Prohesion chamber: the solution shall contain 3.5% sodium chloride and 0.35% ammonium sulfate. The exposure cycle is one hour of salt fog application at ambient followed by one hour drying at 95°F (35°C).

3. Optional Copper-fin evaporator and condenser coils:

a. Shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets.

b. Galvanized steel tube sheets shall not be acceptable.

c. A polymer strip shall prevent coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.

4. Optional E-coated aluminum-fin evaporator and condenser coils:

a. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins.

b. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.

c. Color shall be high gloss black with gloss per ASTM D523-89.

d. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges.

e. Superior hardness characteristics of 2H per ASTM D3363-92A and cross-hatch adhesion of 4B-5B per ASTM D3359-93.

f. Impact resistance shall be up to 160 in.-lb (ASTM D2794-93).

g. Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D224-92 and ASTM D870-92).

h. Corrosion durability shall be confirmed through testing to be no less than 6000 hours salt spray per ASTM B117-90.

5. Optional E-coated aluminum-fin, aluminum tube condenser coils:

a. Shall have a flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers.

b. Coating process shall ensure complete coil encapsulation, including all exposed fin edges.

c. E-coat thickness of 0.8 to 1.2 mil with top coat having a uniform dry film thickness from 1.0 to 2.0 mil on all external coil surface areas, including fin edges, shall be provided.

d. Shall have superior hardness characteristics of 2H per ASTM D3363-00 and cross-hatch adhesion of 4B-5B per ASTM D3359-02.

e. Shall have superior impact resistance with no cracking, chipping or peeling per NSF/ANSI 51-2002 Method 10.2.

I. Refrigerant components:

Refrigerant circuit shall include the following control, safety, and maintenance features:

a. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.

b. Refrigerant filter drier.

c. Service gage connections on suction and discharge lines.

d. Pressure gage access through a specially designed access port in the top panel of the unit.

2. There shall be gage line access port in the skin of the rooftop, covered by a black, removable plug:

a. The plug shall be easy to remove and replace.

b. When the plug is removed, the gage access port shall enable maintenance personnel to route their pressure gage lines.

c. This gage access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.

d. The plug shall be made of a leak proof, UV-resistant, composite material.

3. Compressors:

a. Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.

b. Models shall be available with 2 compressor/2-stage cooling.

c. Compressor motors shall be cooled by refrigerant gas passing through motor windings.

d. Compressors shall be internally protected from high discharge temperature conditions.

e. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.

f. Compressor shall be factory mounted on rubber grommets.

g. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.

h. Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.

J. Filter section:

Filters access is specified in the unit cabinet section of this specification.

2. Filters shall be held in place by a preformed slide out filter tray, facilitating easy removal and installation.

3. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.

4. Filters shall be standard, commercially available sizes.

5. Only one size filter per unit is allowed.

6. 4-in. filter capability is possible with a field-installed pre-engineered slide out filter track accessory. 4-in. filters are field furnished.

K. Evaporator fan and motor:

Evaporator fan motor:

a. Shall have permanently lubricated bearings.

b. Shall have inherent automatic-reset thermal overload protection or circuit breaker.

c. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.

2. Belt-driven evaporator fan:

a. Belt drive shall include an adjustable-pitch motor pulley and belt break protection system.

b. Shall use rigid pillow block bearing system with lubricate fittings at are accessible or lubrication line.

c. Blower fan shall be double-inlet type with forward-curved blades.

d. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

e. Standard on all 17-28 size models with Humidi-MiZer system.

L. Condenser Fans and Motors:

Condenser fan motors:

a. Shall be a totally enclosed motor.

b. Shall use permanently lubricated bearings.

c. Shall have inherent thermal overload protection with an automatic reset feature.

d. Shall use a shaft down design on all sizes.

2. Condenser fans:

a. Shall be a direct driven propeller type fan.

b. Shall have aluminum blades riveted to corrosion resistant steel spiders and shall be dynamically balanced.

M. (23 81 19.13.M.) Special features, options, and accessories:

Integrated Economizer (Factory-installed on 3-phase models only. Field installed on all 3 and 1-phase models):

a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.

b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.

c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.

d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.

e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.

f. Low leak rate models shall be equipped with dampers not to exceed 2% leakage at 1 in. wg pressure differential.

k. Shall be capable of introducing up to 100% outdoor air.

l. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1-2016 and IECC-2015 requirements.

m. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.

n. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory-installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40°F to 100°F (4°C to 38°C). Additional sensor options shall be available as accessories.

o. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.

p. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.

q. Dampers shall be completely closed when the unit is in the unoccupied mode.

r. Economizer controller shall accept a 2 to 10 Vdc CO_2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.

s. Compressor lockout temperature on W7220 is adjustable from –45°F to 80°F, set at a factory default of 32°F. Others shall open at 35°F (2°C) and close at 50°F (10°C).

t. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.

u. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.

5. Integrated EconoMi$er2, and EconoMi$er X Ultra Low Leak rate models. (Factory-installed on 3 phase models only. Field-installed on all 3 and 1 phase models):

a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.

b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.

c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.

d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.

e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.

f. Ultra Low Leak design meets California Title 24 section 140.4 and, ASHRAE 90.1-2016 and IECC-2015 requirements for 4 cfm per sq. ft. on the outside air dampers and 10 cfm per sq. ft. on the return dampers.

13. HACR Breaker:

a. These manual reset devices provide overload and short circuit protection for the unit. Factory wired and mounted with the units, with access cover to help provide environmental protection. On 575V applications, HACR breaker can only be used with WYE power distribution systems. Use on Delta power distribution systems is prohibited.

b. Sized only for the unit as ordered from the factory. Does not accommodate field-installed devices.

14. Convenience outlet:

a. Powered convenience outlet. (Not available on single phase models):

1) Outlet shall be powered from main line power to the rooftop unit.
2) Outlet shall be powered from line side or load side of disconnect by installing contractor, as required by code. If outlet is powered from load side of disconnect, unit electrical ratings shall be UL certified and rated for additional outlet amperage.
3) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
4) Outlet shall include 15 amp GFI receptacles with independent fuse protection.
5) Voltage required to operate convenience outlet shall be provided by a factory-installed step down transformer.
6) Outlet shall be accessible from outside the unit.
7) Outlet shall include a field-installed “Wet in Use” cover.

b. Factory-installed non-powered convenience outlet:

1) Outlet shall be powered from a separate 115-120v power source.
2) A transformer shall not be included.
3) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
4) Outlet shall include 15 amp GFI receptacles.
5) Outlet shall be accessible from outside the unit.
6) Outlet shall include a field-installed “Wet in Use” cover.

c. Field-installed non-powered convenience outlet:

1) Outlet shall be powered from a separate 115-120v power source.
2) A transformer shall not be included.
3) Outlet shall be field-installed and internally mounted with easily accessible 115-v female receptacle.
4) Outlet shall include 20 amp GFI receptacles. This kit provides a flexible installation method which allows code compliance for height requirements of the GFCI outlet from the finished roof surface as well as the capability to relocate the outlet to a more convenient location.
5) Outlet shall be accessible from outside the unit.
6) Outlet shall include a field-installed “Wet in Use” cover.

15. Fan/Filter Status Switch:

a. Switch shall provide status of indoor evaporator fan (ON/OFF) or filter (CLEAN/DIRTY).

b. Status shall be displayed either over communication bus (when used with direct digital controls) or with an indicator light at the thermostat.

16. Thru-the-base connectors:

a. Kits shall provide connectors to permit electrical connections to be brought to the unit through the unit basepan.

b. Minimum of three connection locations per unit.

17. Propeller power exhaust:

a. Power exhaust shall be used in conjunction with an integrated economizer.

b. Independent modules for vertical or horizontal return configurations shall be available.

c. Horizontal power exhaust shall be mounted in return ductwork.

d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0-100% adjustable setpoint on the economizer control.

18. Roof curbs (vertical):

a. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.

b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.

c. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.

20. Outdoor air enthalpy sensor:

a. The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the unit will provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.

21. Return air enthalpy sensor:

a. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.

22. Indoor air quality (CO_2) sensor:

a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.

b. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display. The setpoint shall have adjustment capability.

23. CO_2 sensor (EnergyX):

a. The modulating airflow energy recovery unit shall be capable of incorporating a CO_2 sensor for use with Demand Controlled Ventilation.

b. The CO_2 sensor shall connect to the base rooftop unit's digital controller.

c. The modulating airflow energy recovery unit shall use at a minimum, a high and low CFM airflow set point when a CO_2 sensor is used.

24. Smoke detectors:

a. Shall be a four-wire controller and detector.

b. Shall be environmental compensated with differential sensing for reliable, stable, and drift-free sensitivity.

c. Shall use magnet-activated test/reset sensor switches.

d. Shall have tool-less connection terminal access.

e. Shall have a recessed momentary switch for testing and resetting the detector.

f. Controller shall include:

1) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.
2) Two Form-C auxiliary alarm relays for interface with rooftop unit or other equipment.
3) One Form-C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.
4) Capable of direct connection to two individual detector modules.
5) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.

25. Horn/Strobe Annunciator:

a. Provides an audible/visual signaling device for use with factory-installed option or field-installed accessory smoke detectors.

1) Requires installation of a field-supplied 24-v transformer suitable for 4.2 VA (AC) or 3.0 VA (DC) per horn/strobe accessory.
2) Requires field-supplied electrical box, North American 1-gang box, 2-in. (51 mm) x 4-in. (102 mm).
3) Shall have a clear colored lens.

26. Winter start kit:

a. Shall contain a bypass device around the low pressure switch.

b. Shall be required when mechanical cooling is required down to 25°F (–4°C).

c. Shall not be required to operate on an economizer when below an outdoor ambient of 40°F (4°C).

27. Time guard:

a. Shall prevent compressor short cycling by providing a 5 minute delay (±2 minutes) before restarting a compressor after shutdown for any reason.

b. One device shall be required per compressor.

28. Condensate Overflow Switch:

a. This sensor and related controller monitors the condensate level in the drain pan and shuts down compression operation when overflow conditions occur. It includes:

1) Indicator light - solid red (more than 10 seconds on water contact - compressors disabled), blinking red (sensor disconnected).

2) 10 second delay to break - eliminates nuisance trips from splashing or waves in pan (sensor needs 10 seconds of constant water contact before tripping).

3) Disables the compressor(s) operation when condensate plug is detected, but still allows fans to run for Economizer.

31. Hinged Access panels:

a. Shall provide easy access through integrated quarter turn latches.

b. Shall be on major panels of filter, control box, fan motor and compressor.

32. Display kit for variable frequency drive:

a. Kit allows the ability to access the VFD controller programs to provide special setup capabilities and diagnostics.

b. Kit contains display module and communication cable.

c. Display Kit can be permanently installed in the unit or used on any SAV system VFD controller as needed.

33. California OSHPD Seismic Certification Label:

a. Units meet the seismic capacity requirements of the International Code Council Evaluation Service (ICC-ES) document AC156 (Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems) and per International Building Code (IBC 2009) at an SDS (g) value of 2.00 z/h=1.0, Ip=1.5 and certified by independent structural engineers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.2 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Steam Piping: Comply with applicable requirements in Section 232216. Install shutoff valve and union or flange at each coil supply connection.

3.3 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.4 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
3. Locate nameplate where easily visible.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."
1.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. RTU will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416

SECTION 23 81 00

DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes self-contained heat pump unit ventilators and accessories as indicated on drawings and schedules, and by requirements of this section.

1.2 SUBMITTALS

A. All information in this document, as provided by Modine Manufacturing Company, is provided without representation or warranty of any kind as to the user or any other party, including, without limitation, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR NON-INFRINGEMENT. To the greatest extent permitted by applicable law, Modine Manufacturing Company assumes no liability, and the user assumes all liability and risk, for the use or results from the use of this document or the information contained herein, whether as modified by the user or not. This document must be carefully reviewed by the Engineer to ensure it meets the requirements of the project and local building code(s).

B. As Modine Manufacturing Company has a Continuous Product Improvement program, it reserves the right to change design and specifications without notice.

1.3 QUALITY ASSURANCE

A. Performance: Test and rate Self Contained Heat Pump unit ventilator in accordance with AHRI Standard 390 “Single Packaged Vertical Air Conditioners and Heat Pumps”.

B. The unit shall be listed within the Department of Energy (DOE) Compliance Certification Database (https://www.regulations.doe.gov/certification-data/). Complies with Energy Policy and Conservation Act (42 USC 6311-6317).

C. The unit shall include ETL design certification and the unit nameplate shall include the ETL/ETL Canada listed mark for use in both the US and Canada and must conform to UL 60335-2-40:2022 Ed.4 and be certified to CSA C22.2#60335-2-40:2022 Ed.4 “Household and Similar Electrical Appliances - Safety - Part 2 - 40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners, and Dehumidifiers”. This includes UL 60335-1 and CSA C22.2#60335-1 “Household and Similar Electrical Appliances - Part 1: General Requirements".

D. Unit shall be constructed following ISO: 9001 quality control program procedures and be fully assembled, wired, and tested prior to shipment.

E. ASHRAE 62.1-2010 Compliance: Unit(s) shall comply with applicable requirements of Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten (10) years documented experience.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install a self-contained vertical floor standing heat pump unit ventilator.

B. Not for installation above 7215ft (2200m) elevation.

C. Due to the slightly flammable nature of R-454B, there are minimum room size requirements by unit size to ensure that if there is a refrigerant leak accumulating in the space, it will not reach a density that can become a risk of ignition. Refrigerant charge maximums, minimum room size, and minimum airflow settings should be followed according to UL 60335-2-40 Annex GG.

2.2 MANUFACTURERS

A. Basis-of-Design Product: The design for Single Packaged Vertical Air-Conditioners and Heat Pumps is based on Modine ClassMate Model.

2.3 CABINET

A. Insulation: 1-inch thick, acoustic Hushcloth Polyester/Polyurethane foam with density of 2-pounds per cubic foot containing no fibrous materials. 1-inch thick, acoustic Hushcloth Melamine with barrier and 2" acoustic Hushcloth Melamine with density of 0.56 pounds per cubic foot.
   1. Fire-Hazard Classification: Insulation shall have a fire rating of UL94HF-1.
   2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

B. Cabinet Construction: Constructed from aluminized steel with 20 gauge panels, degreased and coated with electrostatically applied baked-on polyester powder paint, except back panel will remain unpainted.

C. STUDY Acoustic Package: Unit to be constructed with multi-layered premium foam insulation with barrier, and revised airflow paths to maximize acoustic dampening.

D. Cabinet Interior: Interior right and left hand sides shall employ 20 gauge galvanized steel full double wall construction.

E. Cabinet Finish: The unit color shall be Sky White (Hammertone Finish). Paint finish shall be easily cleanable and hard wearing to give maximum protection.

F. Service and Maintenance Access: All service and maintenance access shall be possible through the front of the unit only.

G. Return air openings shall be integrated into the cabinet sides.

H. Access door is factory installed on the front of the unit. Door interior shall be fully insulated to provide for superior noise deadening at front of unit. Door shall employ heavy duty ¼" zinc plated steel plunger hinges with a spring-loaded ¼" zinc plated steel pin to allow for easy removal, if required. Door is secured with two (2) key locks. Door swing designed to turn into itself allowing side of the unit to be installed directly against a wall in the corner of a room.

I. Condensate Connection: Factory installed condensate connection stub provided for connection to the field installed building condensate drain. Tube dimensions 3/4" ID, 1" OD.

2.4 REFRIGERATION SYSTEM

A. Compressor: Two stage hermetic scroll compressor mounted on four (4) 125# all neoprene rubber 35-45 durometer vibration isolators for quiet operation. Compressor contains an internal unloading mechanism to provide capacity control and enable part load efficiencies to be increased.
   1. An internal overload protector included to protect compressor against excessive motor temperatures and currents.
   2. Compressor is equipped with a crankcase heater to guard against liquid flood-back conditions and the elimination of oil foaming upon start up.
   3. Factory set high and low-pressure switches, automatic reset high pressure cutout, and automatic reset low-pressure cutout.

B. Compressor Acoustic Wrap with Base: For improved sound attenuation, compressor casing consists of 18oz PVC barrier laminated to 1/2 inch non-woven polyester. Casing includes integral 4 inch foil backed fiberglass heat shield for use with crankcase heater. Compressor base consists of 2 pound EVA barrier with embedded ¼ inch layered closed cell foam. Cover is easily removable for service.

C. Refrigeration Circuit (Air Source Heat Pump): Heat pump systems shall utilize R-454B and shall be fitted with dual thermal expansion devices and a reversing valve to enable the unit to operate in either cooling or heat pump mode. A factory set defrost control fitted allows defrosting of the outside coil when in heat pump mode. Fitted with factory set automatic reset high-pressure and low-pressure cut-out switches and a sight glass for system observation.

D. Indoor Coil: Coil shall be high capacity 4 row design with copper tubes and mechanically bonded aluminum fins at a spacing of 14 fins per inch. Coil shall be designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. The quick draining coil shall be fitted to a non-corrosive stainless steel drain tray.

E. Outdoor Coil: Enhanced, high efficiency, cross rifled coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

F. A2L Refrigerant Leak Dissipation System
   1. Leak dissipation system shall consist of two A2L sensors certified to UL-60335-2-40.

2. Sensors shall be designed for the life of the unit. Single use refrigerant leak sensors shall not be permitted.
3. Dissipation system shall be automatic, ship pre-wired, and require no additional field connections to function.
4. Refrigerant leak sensors shall be installed in UL-certified location and orientation. Sensors shall be self-correcting and resettable.
5. When the system detects a leak, the following mitigation actions will be initiated until refrigerant has not been detected for at least 5 minutes:
   a. Energize the supply fan to deliver a required minimum amount of circulation airflow.
   b. Disable compressor operation.
   c. Provide an output to energize additional mechanical ventilation (if needed).
   d. Disable electric heat sources.
   e. Provide a 24V alarm dry contact to allow for external notification of leak detection.
   f. Ability to notify BAS system of dissipation event via readable alarm point through BACnet.
   g. Provide recallable dissipation alarm history on Modine Control System Carel controller.
   h. Building fire and smoke systems may override this function via the remote shut down terminals on the unit controls.
6. Dissipation system shall be “Fail Safe” per UL requirements. If a refrigerant sensor has a fault or is disconnected, the unit will initiate the mitigation actions.

2.5 HOT GAS REHEAT

A. Unit is equipped with a reclaim valve and a second condenser coil (reheat coil). When the unit enters the dehumidification mode, the reclaim valve will direct refrigerant to the reheat coil to maintain space dry bulb temperature. When the unit exits dehumidification mode, the valve will revert to directing refrigerant to the outdoor coil for rejection to the outside air.

2.6 FANS AND MOTORS

A. The indoor fan assembly consists of one blower inside teardrop housing assembly engineered specifically for optimal airflow with low noise and minimal power consumption. Blower is powered by electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics is possible for ultra-high efficiency and low audible noise. The ECM provides constant airflow by automatically adjusting the speed if the external static pressure changes. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.

B. Outdoor (Condenser) Fan Assembly: The outdoor fan assembly consists of one backward curved plug fan with centrifugal blower wheel powered by an electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics are possible for ultra-high efficiency and low audible noise. Fan design capable of overcoming external static pressures brought on by rear extensions backs and duct work connected to the fan discharge opening. Fan is sized such that powered relief shall be integral to the unit to prevent over pressurization of the space

when the unit is introducing outside air. Capable of relieving 100% equivalent of the fresh air intake of the unit. Electrical and control wiring to fan assembly includes quick disconnect plug local to assembly.

2.7 FILTER

A. Filter: 2" thick and utilize 17.5 pleats per foot. Filter shall be constructed from 100% Synthetic media and be LEED/Green compliant. Minimum Efficiency Reporting Value of MERV 13 per ASHRAE standard 52.2. 99% Arrestance and 70-80% Dust Spot Efficiency based on the ASHRAE 52.1 - 1992 test method.

2.8 CONTROL PANEL

A. Control Panel: Located at top of the unit behind the front door for direct, centrally located access to controller, controller transformer (24V), and all necessary contactors, relays, and circuit breakers.

B. Wiring: Individually numbered terminal blocks and wires are to match job-specific wiring diagrams. All electrical wires in the control panel will run in an enclosed trough. Wiring outside the control panel to be contained in a protective sleeve. All controls and wiring is factory installed in a clean, organized arrangement.

C. Plug and Socket Wiring: Supply and relief fan decks, compressor, damper assembly, and energy wheel assembly (if applicable) wiring includes plugs local to the assembly allowing for quick wiring disconnect when the component requires removal for service.

D. Unit shall include Economizer Fault Detection and Diagnostics (FDD) as part of the Modine Controls System.
   1. The controller will monitor factory mounted sensors and shall provide system status by indicating the following conditions:
      a. Free cooling available
      b. Economizer enabled
      c. Compressor enabled
      d. Heating enabled (if the system is capable of heating)
      e. Mixed-air low limit cycle active.
   2. Additionally, the controller is capable of detecting and displaying the following faults:
      a. Air Temperature Sensor Failure/Fault
      b. Not Economizing When It Should
      c. Economizing When It Should Not
      d. Damper Not Modulating
      e. Excess Outdoor Air
   3. The Economizer FDD shall be compliant with the applicable requirements of Section 120.2(i)1-120.2(i)8 of Title 24, Part 6 of the California Code of Regulations and JA6.3 of the Joint Appendices.

2.9 ENERGY RECOVERY VENTILATOR WITH ECONOMIZER DAMPER

A. Energy recovery ventilation (ERV) provided within the unit through an enthalpy transfer wheel mounted in an insulated cassette frame complete with seals, drive motor, and belt. The rotary wheel is coated with silica gel desiccant and is sized to handle a maximum of 500 cfm of outside air. The entire assembly shall be a UL tested component. Performance shall be certified in accordance with the ASHRAE Standard 84 method of test and AHRI Rating Standard of 1060.

B. ERV Fans: ERV section employs dual electronically commutated ventilation fans to ensure precise control of airflow through energy wheel and provide optimal wheel frost protection as required.

C. Outside Air Damper: Separate outside air damper and actuator provided for protection from outdoor elements when unit is not in use.

D. Complete energy recovery ventilator installed on rails to allow the entire assembly to be slid out of the unit for service. Electrical and control wiring to damper assembly includes quick disconnect plug local to assembly.

E. Full Economizer Mode: Includes the addition of an economizer damper with actuator and return air damper with actuator. This option enables full economizer functionality by closing off return air allowing up to 100% volume of outside air during free cooling applications.

F. ERV Defrost Cycle: During occupied mode, if the outdoor air temperature falls below 15°F, the microprocessor controller will close the outdoor air damper and de-energize outside air ventilation fan while the wheel and relief air fan continue to run to properly defrost wheel.

2.10 CONTROLS

A. Modine Control System: The unit is fitted with a programmable microprocessor controller provided by the unit manufacturer mounted outside the air stream in the control panel. The controller is designed specifically for operating the unit in its most energy efficient manner using pre-engineered control strategies. The microprocessor determines mode of operation based on the factory installed return air and supply air temperature sensors.

B. The factory Microprocessor Control includes integral compatibility with a BACnet MS/TP control system.

C. Factory installed controls shall enable the unit to operate in the following modes:
   1. If occupancy control is to be initiated by contact closure by others, the contact must be a dry contact only.
   2. Free Cooling – using outside air in favorable conditions
   3. Stage One Mechanical Cooling: 67% capacity compressor, low speed supply fan, reversing valve closed
   4. Stage Two Mechanical Cooling: Controller adjusts compressor capacity and supply fan speed based on load conditions through a sequence that is proprietary to Modine Controls, reversing valve closed
   5. Stage Three Mechanical Cooling: 100% capacity compressor, high speed supply fan, reversing valve closed
   6. Dehumidification: Controller adjusts compressor capacity based on dehumidification requirements through a sequence that is proprietary to Modine Controls, low speed supply fan, hot gas reheat valve is opened, reversing valve closed

D. Factory installed controls will allow the following additional modes of operation during heat pump mode:
   1. Stage One Heating: 67% capacity compressor, low speed supply fan
   2. Stage Two Heating: 67% capacity compressor, high speed supply fan
   3. Stage Three Heating: 100% capacity compressor, high speed supply fan
   4. Stage Four Heating: Hot water heat, high speed supply fan

E. The microprocessor controller shall also modify the minimum damper position to compensate for mode of operation and fan speed.

F. Free Cooling Sequence: If the return air temperature is higher than the occupied set point and if the ambient air temperature is low enough to satisfy the cooling load in the occupied space, the microprocessor controller will de-energize the energy recovery ventilator. Outdoor air ventilation fan is 100% energized and economizer damper and return air damper will automatically modulate between 0-100% allowing up to 100% free cooling to maintain conditioned space temperature. The free cooling mode of operation leads to much reduced running time for the compressor leading to cost and equipment savings.

G. Heat Pump Heating Sequence: If the return air temperature is below the set point and the ambient air temperature is high enough (the heat pump will be locked out at 28°F ambient), the microprocessor controller will de-energize the reversing valve allowing the unit to operate in the reverse cycle DX heating mode. The microprocessor controller will also determine which stage of DX heating is most efficient to handle the heating load based on pre-engineered control strategies and the return air, supply air, and ambient air temperatures. The microprocessor controller will then place the unit in one of two DX heating stages of operation.

H. During periods of operation in low ambient temperature, the unit will periodically enter into a defrost mode to remove the frost build up on the coil acting as the evaporator. The microprocessor controller will de-energize the outdoor fan and energize the reversing valve allowing the unit to operate in the cooling mode using hot refrigerant to melt the frost build up. Defrost cycle will end when outdoor coil sensor is satisfied or when microprocessor defrost time limit expires, whichever comes first. Available alternate heating source will be energized to offset the cooling effect of the defrost cycle.

I. Wall Mounted Digital Thermostat with Humidity Sensor: Digital touchscreen thermostat used in conjunction with the Factory Microprocessor Control displays current room temperature, humidity, CO2 levels, cooling and heating setpoints, warmup time, occupancy override time as well as fan, unit, cooling, heating and dehumidification statuses. The display will also display a remote alarm from the Microprocessor Control. Thermostat allows for occupied temperature and humidity set-point adjustment. The allowable set-point adjustment range can be limited by the Microprocessor Control. Thermostat allows for occupied override activation allowing user to select the amount of time the unit is to remain in the override state. Thermostat mounted remote from the unit.

J. Door Mounted Occupancy Sensor: A passive infrared sensor mounted on the exterior of the unit controls the unit's occupancy mode based on changes in infrared energy (moving body heat) within the coverage area. The occupancy sensor shall utilize a dense wide angle lens, covering up to 2000 sq. ft. of walking motion and 1000 sq. ft. of desktop motion. If the sensor detects movement in the coverage area when the unit is in unoccupied mode, the unit shall switch to occupied mode. If the sensor detects no movement in the coverage area for a predetermined amount of time (adjustable) while the unit is in occupied mode, the unit shall switch to unoccupied or standby mode. The door

has provisions for mounting the sensor and the sensor will ship loose for field installation to prevent damage in shipping.

K. CO2 Sensor: Single beam, dual-wavelength NDIR sensor mounted in the interior return air passage of the unit to provide demand ventilation. When the level of CO2 rises over a predetermined set point, the sensor proportionally adjusts the minimum damper position to allow larger quantities of outside air into the room. The sensor shall have the capability of measuring CO2 levels from 0 to 2,000 ppm with an accuracy of +/- 40 ppm CO2 + 3.0% of the reading.

L. Head Pressure Control Transducer (unit mounted): Installed on liquid line to maintain sufficient head pressure (setpoint is user adjustable), providing required Hot Gas Reheat capacity through condenser fan modulation.

M. Dirty Filter Switch: The unit shall be provided with an internally mounted pressure switch to detect pressure drop across the filters and indicate dirty or clogged filters.

N. The unit shall be provided with an internally mounted current sensor to monitor the status of the energy wheel.

2.11 HOT WATER HEATING

A. Hot Water Coil (unit mounted): Unit is equipped with a one row hot water heating coil integral to the unit mounted in the reheat position relative to the evaporator coil. The coil is manufactured from refrigeration quality copper tubing mechanically bonded onto aluminum fins. Coil is fitted with both an air bleed and a drain plug.

B. The hot water heat option shall include the following piping package features:
1. ¾” two way modulating valve for capacity control
2. Two ¾” manual shut-off valves
3. ¾” hot water strainer
4. ¾” hot water circuit setter
5. ¾” hot water drain with hose and bib
6. ¾” PT Ports
7. Note that some components listed above may be part of a combination package that combines multiple functions of individual components into a single component. Information shown represents functional description.

2.12 ADDITIONAL FACTORY INSTALLED OPTIONS

A. Outdoor Coil Filter: A set of two 20-30 PPI polyester foam washable filters attached to a corrosion resistant metal wire frame fitted across the air inlet of the outdoor coil. Average synthetic dust weight arrestance of 60-80%. The filter is reusable and can be vacuum cleaned.

B. Disconnect Switch: A power disconnect switch sized for the full load amperage of the unit. Allows the unit to be disconnected from the power supply prior to any maintenance. In the off position the switch can be locked out.

2.13 FIELD INSTALLED ACCESSORIES

A. Wall Sleeve: Designed to provide a sealed plenum for the fresh air intake and relief air outlet on the back of the classroom unit to the outside of the building. Intake and relief airstreams are separated with an insulated horizontal splitter plate. A two-piece frame allows for the sleeve to adjust to wall depths between 8” and 14”. Includes double-sided gasket to create an air tight seal between the wall sleeves and the back of the unit.

B. Louver: An outdoor louver suitable for masonry, glass, or panel wall construction. The louvers are flanged style with the following finish:
   1. Aluminum with bird screen and an AAMA 2605 compliant coating (70% Kynar PVDF/100% Fluoropolymer FEVE), Clear Anodized Mica color - Greenheck ESD435 Model - AMCA rated

C. Outside Air Rear Extension: Where site conditions do not permit the use of the standard locations for outside air intake and relief air discharge, an insulated outside air rear extension is supplied for site installation between the back of the unit and the outside wall by the mechanical contractor. The outside air rear extension is 6" deep and with adjustable panels to allow for the relief air discharge to be at a height from floor of 35"- 38".

D. Duct Flange: Field assembled and installed discharge duct flange allowing for easy field connection of a discharge duct to top of the unit.

E. Duct Shroud: 26” three sided duct shroud field mounted on top of the unit for extending the cabinet through the ceiling/soffit. Field trimmed by the installing contractor to suit the ceiling height. Finished and painted to match the unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine areas and conditions under which self-contained heat pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION

A. General: Install self-contained heat pumps in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer’s recommended clearances.

B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer’s submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Ductwork: Refer to Division-15 section "Ductwork". Connect supply and return ducts to units with flexible duct connections. Provide transitions to exactly match unit duct connection size.

D. Drain Piping: Connect indoor coil condensate drain to nearest indirect waste connection, or as indicated.

E. Drain Piping: Connect outdoor coil condensate drain to nearest indirect waste connection, or as indicated.

3.3 FIELD QUALITY CONTROL

A. See section 01-4000 – Quality Requirements, for additional requirements.

3.4 SYSTEM STARTUP

3.5 WARRANTY

A. Standard Unit Warranty:
   1. For units equipped with Modine Controls System - All Components Warranty: Two years from date of first beneficial use by buyer or any other user, within two years from date of resale by buyer in any unchanged condition, or within 30 months from date of shipment from seller, whichever occurs first.

B. Compressor Only- Extended 5 Year Warranty Includes:
   1. Supplemental 4 year compressor warranty to extend the warranty on the compressor against defects in material and workmanship to a full 5 years. All other terms and conditions of Commercial Warranty Apply.

SECTION 23 8129
VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:

1. Indoor, concealed, ceiling-mounted units for ducting.
2. Outdoor, air-source, heat pump units.
3. System controls.
4. System refrigerant and oil.
5. System condensate drain piping.
6. System hydronic piping.
7. System refrigerant piping.
8. Metal hangers and supports.
9. Metal framing systems.
10. Fastener systems.
11. Pipe stands.
12. Equipment stands.
13. Miscellaneous support materials.
14. Piping and tubing insulation.
15. System control cable and raceways.

1.2 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.

B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

E. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

F. VRF: Variable refrigerant flow.

1.3 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: For VRF HVAC systems.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For fully and partially exposed indoor units with factory finishes viewable by occupants.

D. Delegated-Design Submittals:

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
3. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
4. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, using input from installers of the items involved.

B. Qualification Data:

1. For Installer.
2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

C. Seismic Qualification Data: Certificates, for equipment, accessories, and components, from manufacturer.

D. Product Certificates: For each type of product.

E. Product test reports.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

A. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. In-place facility located within reasonable distance of Project.
3. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
4. Demonstrated past experience on five projects of similar complexity, scope, and value.

    a. Each person assigned to Project shall have demonstrated past experience.

5. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
6. Service and maintenance staff assigned to support Project during warranty period.
7. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.
8. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.

    a. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
    b. Demonstrated past experience on five projects of similar complexity, scope, and value.

C. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period:

    a. For Compressor: 10 years from date of Substantial Completion.
    b. For Parts, Including Controls: Seven years from date of Substantial Completion.
    c. For Labor: Five > years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Daikin Applied.

2. Trane-Mistubishi

3. Carrier Corp.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units,outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

1. Two-pipe system design.
2. System(s) operation: heat recovery as indicated on Drawings.
3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. AHRI Compliance: System and equipment performance certified according to AHRI 1230[and products listed in AHRI directory].

D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

1. Provide system refrigerant calculations.

    a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.

b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.

2. Include a mechanical ventilation system and gas detection system as required to comply with ASHRAE 15 and governing codes.
3. System Refrigerant Piping and Tubing:

   a. Arrangement: Arrange piping to interconnect indoor unitsand outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
   b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
   c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.

4. System Controls:

   a. Network arrangement.
   b. Network interface with other building systems.
   c. Product selection.
   d. Sizing.

B. Service Access:

1. Provide and document service access requirements.
2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

C. System Design and Installation Requirements:

1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

D. System Adaptability to Future Changes: Arrange and size system refrigerant piping to accommodate future changes to system without having to resize and replace existing refrigerant piping.

1. Future changes to system(s) indicated on Drawings.
2. Each branch circuit shall accommodate addition of one indoor unit minimum with unit capacity equal to average capacity requirement indoor unit connected to the branch circuit.
3. Each branch circuit shall accommodate deletion of one indoor unit minimum with unit capacity equal to average capacity requirement indoor unit connected to the branch circuit.
4. Owner approval required for future changes.

E. Isolation of Equipment: Provide isolation valves to isolate each indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

F. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Not less than [50] percent.
2. Not more than [130] percent.
3. Range acceptable to manufacturer.

G. System Turndown: Stable operation down to [20] percent of outdoor-unit capacity.

H. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

I. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.

    a. Design equipment and supports to withstand wind loads of governing code [and ASCE/SEI 7]
    b. Design equipment and supports to withstand snow and ice loads of governing code [and ASCE/SEI 7]
    c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.

2. Maximum System Operating Outdoor Temperature: [See Drawings] .
3. Minimum System Operating Outdoor Temperature: [See Drawings] .

J. Seismic Performance: VRF HVAC system(s) shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] .

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified [and the system will be fully operational after the seismic event]."
2. Component Importance Factor: [1.5]
3. Compliant Component Amplification Factor and Component Response Modification Factor shall be used.

K. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.

1. Indoor: See Drawings, Within design guidelines of "2015 ASHRAE HANDBOOK- HVAC Applications."
2. Outdoor: See Drawings, Within ordinance of governing authorities .

L. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

M. Capacities and Characteristics: As indicated on Drawings.

2.4 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:

1. Material: [Galvanized] [or] [painted] steel.
2. Insulation: Manufacturer's standard internal insulation[, complying with ASHRAE 62.1,] to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material[with threaded NPT].

E. Fan and Motor Assembly:

1. Fan(s):

a. Direct-drive arrangement.
b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: [ASHRAE 52.2, MERV 7] [ASHRAE 52.2, MERV 11] [ASHRAE 52.2, MERV 13] .
3. Media:[If more than one filter type is indicated, Contractor has option to choose.]

    a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
    b. Washable: Manufacturer's standard filter with antimicrobial treatment.

G. Unit Accessories:

1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control sized to allow sequence of operation indicated on Drawings.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
3. .

H. Unit Controls:

1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

    a. Unit inlet air temperature.
    b. Coil entering refrigerant temperature.
    c. Coil leaving refrigerant temperature.
    d. Sensor.

4. Features and Functions:

    a. Self-diagnostics.
    b. Time delay.
    c. Auto-restart.
    d. External static pressure control.
    e. Auto operation mode.
    f. Manual operation mode.
    g. Filter service notification.
    h. Power consumption display.
    i. Drain assembly high water level safety shutdown and notification.
    j. Run test switch.

5. Communication: Network communication with other indoor and outdoor units.
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

I. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

6. Raceways: Enclose line voltage wiring in [metal]raceways.

2.5 OUTDOOR, AIR-SOURCE HEAT-PUMP UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with either all heating or all cooling demands, but not for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:

1. Galvanized steel and coated with a corrosion-resistant finish.

    a. Coating with documented salt spray test performance of [1000] hours according ASTM B117 surface scratch test (SST) procedure.

2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to [15] percent of rated capacity.
2. Protection: Integral protection against the following:

    a. High refrigerant pressure.
    b. Low oil level.
    c. High oil temperature.
    d. Thermal and overload.
    e. Voltage fluctuations.
    f. Phase failure and phase reversal.
    g. Short cycling.

3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.
6. Crankcase heaters with integral control to maintain safe operating temperature.
7. Fusible plug.

D. Condenser Coil Assembly:

1. Plate Fin Coils:

    a. Casing: Aluminum, galvanized, or stainless steel.
    b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
    c. Tubes: Copper, of diameter and thickness required by performance.

2. Aluminum Microchannel Coils:

    a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
    b. Single- or multiple-pass arrangement.
    c. Construct fins, tubes, and header manifolds of aluminum alloy.

3. Coating: [None] [Corrosion resistant].
4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

E. Condenser Fan and Motor Assembly:

1. Fan(s): Propeller type.

    a. Direct-drive arrangement.
    b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
    c. [Statically and]dynamically balanced.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least [75] percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

    a. Refrigerant suction temperature.
    b. Refrigerant discharge temperature.
    c. Outdoor air temperature.
    d. Refrigerant high pressure.
    e. Refrigerant low pressure.
    f. Oil level.

4. Communication: Network communication with indoor units and other outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.

5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in [metal]raceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel. Coat exposed surfaces with additional corrosion-resistant coating if required to prevention corrosion when exposed to salt spray test for [1000] hours according ASTM B117.

J. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.6 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units[, HRCUs,] and outdoor units shall include integral controls and connect through a [TIA-485A] [or] [manufacturer-selected] control network.
2. Network Communication Protocol: [Manufacturer proprietary] [or] [open] control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:

   a. Ethernet connection via RJ-45 connectors and port with transmission at [100] Mbps or higher.
   b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least [5 minutes] of battery backup operation after a power loss.
   c. Integration shall include [control] [monitoring] [scheduling] [change of value notifications] .

4. Operator Interface:

   a. Operators shall interface with system and unit controls through the following:

      1) Operator interfaces integral to controllers.
      2) Owner-furnished PC connected to central controller(s).
      3) Web interface through web browser software.
      4) Integration with Building Automation System.

   b. Users shall be capable of interface with controllers for control of indoor units to extent privileges are enabled. Control features available to users shall include the following:

      1) On/off control.
      2) Temperature set-point adjustment.

B. VRF HVAC System Operator Software for PC:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.

2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Multiple Languages: [English] [or] [Spanish]
10. Supports Imperial and Metric Temperature Units: [Fahrenheit] [or] [Celsius] [Fahrenheit and Celsius].
11. Displays service notifications and error codes.
12. Monitors and displays up to [3000] item error history and [10000] item operation history for regular reporting and further archiving.
13. Monitors and displays cumulative operating time of indoor units.
14. Able to disable and enable operation of individual controllers for indoor units.
15. Information displayed on individual controllers shall also be available for display.
16. Information displayed for outdoor units, including refrigerant high and low pressures [percent capacity] <Insert outdoor unit displays>.

C. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.

    a. Include multiple interconnected controllers as required.

2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures [percent capacity] .

11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel[and web accessible through standard web browser software].

D. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: [English] [or [Spanish] .
4. Temperature Units: [Fahrenheit] [or] [Celsius] [Fahrenheit and Celsius].
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent increments.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to [eight] events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection.
17. Service Notification Display: "Filter".
18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
21. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
22. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

E. Wireless Controllers for Indoor Units:

1. Wireless Communication:

    a. Controller communicates to remote-mounted receiver that is wired to indoor unit(s).

        1) Include receivers with wireless controllers as required to complete installation.
        2) Low-voltage power required for receivers shall be powered through non-polar connections to indoor unit.

    b. One wireless controller shall be capable of communicating with one or multiple receivers to control one or multiple indoor units as a group.

2. Controller Battery Life: [Three] years.
3. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
4. Multiple Language: [English] [or] [Spanish] .
5. Temperature Units: [Fahrenheit] [or] [Celsius] [Fahrenheit and Celsius].
6. On/Off: Turns indoor unit on or off.
7. Hold: Hold operation settings until hold is released.
8. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.

9. Temperature Display: 1-degree increments.
10. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments.
11. Relative Humidity Display: 1 percent increments.
12. Relative Humidity Set-Point: Adjustable in 1 percent increments.
13. Fan Speed Setting: Select between available options furnished with the unit.
14. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
15. Seven-day programmable operating schedule with up to [eight] events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
16. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
17. Occupancy detection.
18. Service Notification Display: "Filter"
19. Service Run Tests: Limit use by service personnel to troubleshoot operation.
20. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
21. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
22. Setting stored in non-volatile memory to ensure that settings are not lost if power is lost. Battery for date and time only.

2.7 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, [Class A2L refrigerant classification.
3. R-454b

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.8 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. Copper Tubing:

1. Drawn-Temper Tubing: According to ASTM B88, Type L
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B32, lead-free alloys, and water-flushable flux according to ASTM B813.

C. CPVC plastic pipe according to ASTM F441/F441M, Schedule 40, with socket-type pipe fittings according to ASTM F438 and solvent cement according to ASTM F493.

D. PVC plastic pipe according to ASTM D1785, Schedule 40, with socket-type pipe fittings according to ASTM D2466 and solvent cement according to ASTM D2564, primer according to ASTM F656.

2.9 SYSTEM HYDRONIC PIPING

A. Comply with requirements in Section 232113 "Hydronic Piping" for system piping requirements.

2.10 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Refrigerant Piping:

1. Copper Tube: [ASTM B280, Type ACR] .
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.

C. Refrigerant Tubing Kits:

1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
5. Factory Charge: [Dehydrated air or nitrogen] .

D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

E. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.11 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of [galvanized or copper-coated steel] [stainless steel] .

B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of [galvanized steel] [stainless steel] .

2.12 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Unistrut; Atkore International.
    b. Wesanco, Inc.

2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted [carbon-steel] [stainless steel, Type 304] [stainless steel, Type 316] [extruded-aluminum] channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of [galvanized steel] <Insert material> for use indoors and of [stainless steel] <Insert material> for use outdoors.
7. Metallic Coating for Use Indoors: [No coating] [Electroplated zinc] [Hot-dip galvanized] [Gold (yellow zinc dichromate) galvanized].
8. Plastic Coating for Use Outdoors: [PVC] [polyurethane] [epoxy] [or] [polyester].

2.13 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: [Zinc-coated] [or] [stainless] steel.
2. Outdoor Applications: Stainless steel.

2.14 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. MIRO Industries.
    b. PHP Systems/Design.
    c. RectorSeal HVAC; a CSW Industrials Company.
    d. Rooftop Support Systems; Eberl Iron Works, Inc.

2. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.

a. Recycled content.>

4. Hardware: Galvanized steel or polycarbonate.
5. Accessories: Protection pads.

C. Low-Profile, Single-Base, Single-Pipe Stand:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. MIRO Industries.
   b. PHP Systems/Design.
   c. Rooftop Support Systems; Eberl Iron Works, Inc.

2. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.

3. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.

   a. Recycled content.>

4. Vertical Members: Two, [galvanized-steel] [stainless steel], continuous-thread 1/2-inch rods.
5. Horizontal Member: Adjustable horizontal, [galvanized-steel] [stainless steel] pipe support channels.
6. Pipe Supports: [Roller] [Strut clamps] [Clevis hanger] [Swivel hanger].
7. Hardware: [Galvanized] [Stainless] steel.
8. Accessories: Protection pads.
9. Height: [12 inches above roof] .

D. High-Profile, Single-Base, Single-Pipe Stand:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. MIRO Industries.
   b. PHP Systems/Design.
   c. Rooftop Support Systems; Eberl Iron Works, Inc.

2. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

3. Base: Single vulcanized rubber or molded polypropylene.

   a. Recycled content.>

4. Vertical Members: Two, [galvanized-steel] [stainless steel], continuous-thread 1/2-inch rods.
5. Horizontal Member: One, adjustable height, [galvanized-steel] [or] [stainless steel] pipe support slotted channel or plate.
6. Pipe Supports: [Roller] [Clevis hanger] [Swivel hanger].
7. Hardware: [Galvanized] [Stainless] steel.
8. Accessories: Protection pads[, 1/2-inch continuous-thread galvanized-steel rod] [, 1/2-inch continuous-thread stainless steel rod].
9. Height: [36 inches above roof] .

E. High-Profile, Multiple-Pipe Stand:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. MIRO Industries.
    b. PHP Systems/Design.
    c. RectorSeal HVAC; a CSW Industrials Company.
    d. Rooftop Support Systems; Eberl Iron Works, Inc.

2. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

3. Bases: Two or more; [vulcanized rubber] [molded polypropylene] .

    a. Recycled content.>

4. Vertical Members: Two or more, [galvanized-steel] [stainless steel] channels.
5. Horizontal Members: One or more, adjustable height, [galvanized-steel] [stainless steel] pipe support.
6. Pipe Supports: [Roller] [Strut clamps] [Clevis hanger] [Swivel hanger].
7. Hardware: [Galvanized] [Stainless] steel.
8. Accessories: Protection pads[, 1/2-inch continuous-thread rod].
9. Height: [36 inches above roof] <Insert lesser dimension above roof>.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.15 OUTDOOR EQUIPMENT STANDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. MIRO Industries.
2. RectorSeal HVAC; a CSW Industrials Company.
3. RectorSeal HVAC; a CSW Industrials Company.
4. Rooftop Support Systems; Eberl Iron Works, Inc.

B. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof-supported outdoor equipment components, without roof membrane penetration, in a prefabricated system that can be modularly assembled on-site.

C. Foot Material: Rubber or polypropylene.

D. Rails Material: Hot-dip galvanized carbon steel.

E. Wind/Sliding Load Resistance: Up to [100 mph].

2.16 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.17 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.

B. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

   a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
   b. Indoors: 1/2 inch thick.
   c. Outdoors: 3/4 inch thick.

2. Field-Applied Jacket:

   a. Concealed: None required.
   b. Indoors, Exposed to View: Factory ASJ with vaport barrier.
   c. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick .

C. Refrigerant Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

   a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
   b. Indoors: 1 inch thick.
   c. Outdoors: 1 inch thick.

2. Field-Applied Jacket:

   a. Concealed: None required.
   b. Indoors, Exposed to View: None required
   c. Outdoors, Exposed to View: [None required] [Aluminum, smooth, 0.020 inch thick] .

D. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Llow emitting adhesives.>

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Low emitting adhesives.>

F. Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

5. Sealants.>

2.18 SYSTEM CONTROL CABLE AND RACEWAYS

A. Low-Voltage Control Cabling:

1. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

B. TIA-485A Network Cabling:

1. Standard Cable: NFPA 70, Type CMG.
2. Plenum-Rated Cable: NFPA 70, Type CMP.

C. Ethernet Network Cabling: TIA-568-C.2 Category [6] [6a] cable with [RJ-45] connectors.

D. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.19 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a [3000] -hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in-lb .
c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: [Immersion] [Spray].
3. Thickness: [1 mil].
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.20 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by [manufacturer's service representative] [or] [system Installer under supervision of manufacturer's service representative].

C. Equipment Restraint Installation: Install equipment with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

D. Indoor Unit Installations:

1. Install units to be level and plumb while providing a neat and finished appearance.
2. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
3. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
4. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
5. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
6. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.
7. Provide lateral bracing if needed to limit movement of suspended units to not more than [0.25 inch].
8. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.
9. Floor-mounted units located in [mechanical] rooms.
10. Install floor-mounted units on support structure indicated on Drawings.
11. Install floor-mounted units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
12. Attachment: Install hardware for proper attachment to supported equipment.
13. Grouting: Place grout under equipment supports and make bearing surface smooth.

E. Outdoor Unit Installations:

1. Install units to be level and plumb while providing a neat and finished appearance.

2. Install outdoor units on support structures indicated on Drawings.
3. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

    a. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
    b. Grouting: Place grout under equipment supports and make bearing surface smooth.

4. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, stainless-steel fasteners.

3.2 GENERAL REQUIREMENTS FOR PIPING AND TUBING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 CONDENSATE DRAIN PIPE AND TUBING INSTALLATION

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.

3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.
    b. Manufacturer's requirements.
    c. Governing codes.
    d. In the absence of requirements, comply with requirements of ASHRAE handbooks.

4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than [one to two] percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.4 HYDRONIC PIPING AND TUBING INSTALLATION

A. Comply with requirements for hydronic pipe and tubing specified in Section 232113 "Hydronic Piping."

B. Comply with requirements for hydronic specialties specified in Section 232116 "Hydronic Piping Specialties."

C. Comply with requirements for ball valves specified in Section 230523.12 "Ball Valves for HVAC Piping."

D. Comply with requirements for butterfly valves specified in Section 230523.13 "Butterfly Valves for HVAC Piping."

E. Comply with requirements for check valves specified in Section 230523.14 "Check Valves for HVAC Piping."

F. Install continuous-thread hanger rods and [elastomeric] [spring] hangers of size required to support equipment weight.

1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

G. Where installing piping and tubing adjacent to equipment, allow space for service and maintenance.

3.5 REFRIGERANT PIPING AND TUBING INSTALLATION

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed [5 feet]. Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:

1. Ream ends of tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

    a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
    b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.6 PIPE AND TUBING INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 DUCT, ACCESSORIES, AND AIR OUTLETS INSTALLATION

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."

C. Comply with requirements for nonmetal ducts specified in Section 233116 "Nonmetal Ducts."

D. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."

E. Comply with requirements for flexible ducts specified in Section 233346 "Flexible Ducts."

F. Comply with requirements for air diffusers specified in Section 233713.13 "Air Diffusers."

G. Comply with requirements for registers and grilles specified in Section 233713.23 "Registers and Grilles."

3.8 SOFTWARE

A. Cybersecurity:

1. Software:

a. Coordinate security requirements with [IT department] [CIO] .
b. Ensure that latest stable software release is installed and properly operating.
c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.

2. Hardware:

    a. Coordinate location and access requirements with [IT department] [CIO] .
    b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
    c. Disable dual network connections.

3.9 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than [1.2] times VRF HVAC system operating pressure, but not less than [600 psig] , using [dry nitrogen] .
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of [24] hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:

    a. Name of person starting test, company name, phone number, and e-mail address.
    b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    c. Detailed description of extent of tubing tested.
    d. Date and time at start of test.
    e. Test pressure at start of test.
    f. Outdoor temperature at start of test.
    g. Name of person ending test, company name, phone number, and e-mail address.
    h. Date and time at end of test.
    i. Test pressure at end of test.
    j. Outdoor temperature at end of test.
    k. Remarks:

5. Submit test reports for Project record.

C. Refrigerant Tubing Evacuation Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of [500] microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of [one] hour(s) with no change.
4. Prepare test report to record the following information for each test:

    a. Name of person starting test, company name, phone number, and e-mail address.
    b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    c. Detailed description of extent of tubing tested.
    d. Date and time at start of test.
    e. Test pressure at start of test.
    f. Outdoor temperature at start of test.
    g. Name of person ending test, company name, phone number, and e-mail address.
    h. Date and time at end of test.
    i. Test pressure at end of test.
    j. Outdoor temperature at end of test.
    k. Remarks:

5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

D. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

E. Products will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.11 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be [an employee] [or] [a factory-trained and -authorized service representative] of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit[, HRCU,] and outdoor unit for proper condensate removal.

5. Check sound levels of each indoor[and outdoor] unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than [two] hours of continuous operation of each system and submit with report for historical reference.

a. All available system operating parameters shall be included in the information submitted.

E. Witness:

1. Invite [Architect] [Owner] [and] [Commissioning Agent] to witness startup service procedures.
2. Provide written notice not less than [20] business days before start of startup service.

3.12 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within [12] months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [two] visits to Project during other-than-normal occupancy hours for this purpose.

3.13 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for [two] years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within [two] years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least [30] days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.14 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's [employed training instructor] [or] [factory-authorized service representative] to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

END OF SECTION 238129

SECTION 26 0519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Fire-alarm wire and cable.
4. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire; brand of Belden, Inc.
2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable; Prysmian Group North America.
5. Southwire Company, LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:
1. Type RHH and Type RHW-2: Comply with UL 44.

2. Type USE-2 and Type SE: Comply with UL 854.
3. Type THHN and Type THWN-2: Comply with UL 83.
4. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
5. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems; Atkore International.
2. Alpha Wire; brand of Belden, Inc.
3. Encore Wire Corporation.
4. General Cable; Prysmian Group North America.
5. Southwire Company, LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

H. Armor: Aluminum, interlocked.

I. Jacket: PVC applied over armor.

2.3 FIRE-ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Wire & Cable Inc.

2. Prysmian Cables and Systems; Prysmian Group North America.
3. Radix Wire.
4. Southwire.
5. West Penn Wire; brand of Belden, Inc.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Electrical Products.
2. ABB, Electrification Business.
3. AFC Cable Systems; Atkore International.
4. Hubbell Utility Solutions; Hubbell Incorporated.
5. ILSCO.
6. Ideal Industries, Inc.
7. NSi Industries LLC.
8. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
9. TE Connectivity Ltd.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper, Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 28 0528 "Pathways for Electronic Safety and Security."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.

    a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted.
4. Signaling Line Circuits: Power-limited fire-alarm cables must not be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

D. Comply with requirements in Section 28 4621.11 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 8413 "Penetration Firestopping."

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries Inc.; Electrical Products Division, LLC.
6. Harger Lighting and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lighting, Inc.
10. Siemens Power Transmission & Distribution, Inc..

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

J. Straps: Solid copper, copper lugs. Rated for 600 A.

K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

L. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.

a. Material: Die-cast zinc alloy.
b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor

with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Substations and Pad-Mounted Equipment: 5 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABB, Electrification Business.
   b. Allied Tube & Conduit; Atkore International.
   c. Cooper B-line; brand of Eaton, Electrical Sector.
   d. Unistrut; Atkore International.
   e. Wesanco, Inc.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized steel.
4. Channel Width: Selected for applicable load criteria.
5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-line; brand of Eaton, Electrical Sector.
2) Empire Industries, Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M, Grade A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.

B. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

END OF SECTION

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Type EMT-S raceways and elbows.
2. Type ERMC-S raceways, elbows, couplings, and nipples.
3. Type FMC-S and Type FMC-A raceways.
4. Type IMC raceways.
5. Type LFMC raceways.
6. Type PVC raceways and fittings.
7. Fittings for conduit, tubing, and cable.
8. Threaded metal joint compound.
9. Solvent cements.
10. Surface metal raceways and fittings.
11. Metallic outlet boxes, device boxes, and covers.
12. Junction boxes, and pull boxes.
13. Cover plates for device boxes.
14. Hoods for outlet boxes.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Floor boxes.
4. Cabinets and cutout boxes.

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.

g. Thomas & Betts Corporation.
h. Wheatland Tube Company.

2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL 797 and UL Category Control Number FJMX.
2) Material: Steel.
3) Exterior Coating: Zinc.
4) Interior Coating: Zinc with organic top coating.

c. Options:

1) Minimum Trade Size: 1/2 inch.
2) Colors: As indicated on Drawings.

2.2 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AFC Cable Systems, Inc..
b. Allied Tube & Conduit.
c. Anamet Electrical, Inc..
d. Electric-Flex Company.
e. O-Z/Gedney.
f. Southwire Company.
g. Thomas & Betts Corporation.
h. Wheatland Tube Company.

2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL 6 and UL Category Control Number DYIX.
2) Exterior Coating: Zinc.
3) Interior Coating: Zinc with organic top coating.

c. Options:

1) Minimum Trade Size: 1/2 inch.
2) Colors: As indicated on Drawings.

2.3 TYPE FMC-S AND TYPE FMC-A RACEWAYS

A. Steel Flexible Metal Conduit (FMC-S):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.

2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standard: UL 1 and UL Category Control Number DXUZ.
      2) Material: Steel.

   c. Options:

      1) Minimum Trade Size: 1/2 inch.
      2) Colors: As indicated on Drawings.

2.4 TYPE IMC RACEWAYS

A. Steel Electrical Intermediate Metal Conduit (IMC):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.

2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standard: UL 1242 and UL Category Control Number DYBY.
      2) Exterior Coating: Zinc.
      3) Interior Coating: Zinc with organic top coating.

   c. Options:

      1) Minimum Trade Size: 1/2 inch.

2) Colors: As indicated on Drawings.

2.5 TYPE LFMC RACEWAYS

A. Steel Liquidtight Flexible Metal Conduit (LFMC-S):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.
2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standard: UL 360 and UL Category Control Number DXHR.
      2) Material: Steel.

   c. Options:

      1) Minimum Trade Size: 1/2 inch.

3. Colors: As indicated on Drawings.

2.6 TYPE PVC RACEWAYS AND FITTINGS

A. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.
2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 651 and UL Category Control Number DZYR.
      2) Dimensional Specifications: Schedule 40.

c. Options:

1) Minimum Trade Size: 1/2 inch.

B. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.
2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 651 and UL Category Control Number DZYR.
      2) Dimensional Specifications: Schedule 80.

   c. Options:

      1) Minimum Trade Size: 1/2 inch.

2.7 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Fittings for Type ERMC, Type IMC, and Type PVC Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.
2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 514B and UL Category Control Number DWTT.
      2) Material: Steel.
      3) Coupling Method: Compression coupling or Raintight compression coupling with distinctive color gland nut.

c. Options:

1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

B. Fittings for Type EMT Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.
2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 514B and UL Category Control Number FKAV.
      2) Material: Steel.
      3) Coupling Method: Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.

   c. Options:

      1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
      2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

C. Fittings for Type FMC Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.
2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 514B and UL Category Control Number ILNR.

D. Fittings for Type LFMC Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFC Cable Systems, Inc..
   b. Allied Tube & Conduit.
   c. Anamet Electrical, Inc..
   d. Electric-Flex Company.
   e. O-Z/Gedney.
   f. Southwire Company.
   g. Thomas & Betts Corporation.
   h. Wheatland Tube Company.
2. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 514B and UL Category Control Number DXAS.

2.8 SOLVENT CEMENTS

A. Solvent Cements for Type PVC Raceways and Fittings:
   1. Applicable Standards:

      a. General Characteristics:

         1) Reference Standards: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.

2.9 SURFACE METAL RACEWAYS AND FITTINGS

A. Surface Metal Raceways and Fittings with Metal Covers:

   1. Manufacturers: Subject to compliance with requirements, provide products by:
      a. Legrand; Wiremold
   2. Applicable Standards:

      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:

         1) Reference Standards: UL 5 and UL Category Control Number RJBT.

      c. Options:

         1) Galvanized steel base with snap-on covers.
         2) Prime coated, ready for field painting.
         3) Wiring Channels: [**Single**] [**Dual**] [**Triple**]. Multiple channels must be capable of housing a standard 20 to 30 A NEMA device flush within the raceway.

2.10 METALLIC OUTLET BOXES, DEVICE BOXES, AND COVERS

A. Metallic Outlet Boxes:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Applicable Standards:

    a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    b. General Characteristics:

        1) Reference Standards: UL 514A and UL Category Control Number QCIT.

    c. Options:

        1) Material: Sheet steel.
        2) Sheet Metal Depth: Minimum 1.5 inch.
        3) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.

B. Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
2. Applicable Standards:

    a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    b. General Characteristics:

        1) Reference Standards: UL 514A and UL Category Control Number QCIT.

C. Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Applicable Standards:

    a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
    b. General Characteristics:

        1) Reference Standards: UL 514A and UL Category Control Number QCIT.

    c. Options:

        1) Material: Sheet steel.
        2) Sheet Metal Depth: minimum 1.5 inch.
        3) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.

D. Metallic Floor Boxes and Floor Box Covers:

1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL 514A and UL Category Control Number QCIT.

E. Metallic Recessed Access-Floor Boxes and Recessed Floor Box Covers:

1. Description: Floor box with provisions for mounting wiring devices below floor surface and floor box cover with provisions for passage of cords to recessed wiring devices mounted within floor box.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL 514A and UL Category Control Number QCIT.

F. Metallic Concrete Boxes and Covers:

1. Description: Box intended for use in poured concrete.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL 514A and UL Category Control Number QCIT.

2.11 JUNCTION BOXES AND PULL BOXES

A. Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL Category Control Number BGUZ.

a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.

c. Options:

1) Degree of Protection: Type 1.

B. Indoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL Category Control Number BGUZ.

a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.

c. Options:

1) Degree of Protection: Type 1.

C. Indoor Polymeric Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL Category Control Number BGUZ.

a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.

c. Options:

1) Degree of Protection: Type 1.

D. Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL Category Control Number BGUZ.

a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.

c. Options:

1) Degree of Protection: Type 3R.

E. Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL Category Control Number BGUZ.

a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.

c. Options:

1) Degree of Protection: Type 3R.

F. Outdoor Polymeric Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL Category Control Number BGUZ.

a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.

c. Options:

1) Degree of Protection: Type 3R.

2.12 HOODS FOR OUTLET BOXES

A. Retractable or Reattachable Hoods for Outlet Boxes:

1. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
      2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
      3) Mounts to box using fasteners different from wiring device.

   c. Options:

      1) Provides clear, weatherproof, "while-in-use" cover.

B. Extra-Duty, While-in-Use Hoods for Outlet Boxes:

1. Applicable Standards:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:

      1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
      2) Marked "Extra-Duty" in accordance with UL 514D.
      3) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
      4) Mounts to box using fasteners different from wiring device.

   c. Options:

      1) Provides clear, weatherproof, "while-in-use" cover.
      2) Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:

1. Exposed Conduit: ERMC or IMC.

2. Concealed Conduit, Aboveground: ERMC or IMC.
3. Direct-Buried Conduit: PVC-40.
4. Concrete-Encased Conduit Not in Trench: PVC-40.
5. Concrete-Encased Conduit in Trench: PVC-40.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:
1. Exposed and Subject to Physical Damage: ERMC. Raceway locations include the following:
    a. Loading docks.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.
2. Exposed, Not Subject to Physical Damage: EMT.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Damp or Wet Locations: ERMC or IMC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.

D. Stub-ups to Above Recessed Ceilings: Provide EMT, IMC, or ERMC for raceways.

E. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC and IMC: Provide threaded type fittings unless otherwise indicated.

3.2 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:
1. Outdoors:
    a. Type 3R unless otherwise indicated.
    b. Locations Exposed to Hosedown: Type 4.
    c. Locations Subject to Potential Flooding: Type 6P.
    d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
    e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
    f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
2. Indoors:
    a. Type 1 unless otherwise indicated.
    b. Damp or Dusty Locations: Type 12.
    c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
    d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
    e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.

f. Locations Exposed to Hosedown: Type 4.
g. Locations Exposed to Brief Submersion: Type 6P.
h. Locations Exposed to Prolonged Submersion: Type 6P.
i. Locations Exposed to Corrosive Agents: Type 4X.
j. Locations Exposed to Spraying Oil or Coolants: Type 13.

C. Exposed Boxes Installed Less Than 6.5 ft. Above Floor:

1. Boxes with knockouts or unprotected openings are prohibited.
2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
6. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
7. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4 inch trade size and insulated throat metal bushings on 1-1/2 inch trade size and larger conduits terminated with locknuts.
8. Raceway Terminations at Locations Subject to Moisture or Vibration:

a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft. above finished floor.
3. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
4. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
5. Support conduit within 12 inch of enclosures to which attached.
6. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.

7. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where an underground service raceway enters a building or structure.
    c. Conduit extending from interior to exterior of building.
    d. Conduit extending into pressurized duct and equipment.
    e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    f. Where otherwise required by NFPA 70.

8. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
9. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
10. Keep raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
11. Cut conduit perpendicular to the length. For conduits 2 inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
12. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

C. Requirements for Installation of Specific Raceway Types:

1. Types ERMC and IMC:

    a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

2. Types FMC and LFMC:

    a. Comply with NEMA RV 3. Provide a maximum of 36 inch of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

3. Type PVC:

    a. Do not install Type PVC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
    b. Comply with manufacturer's written instructions for solvent welding and fittings.

D. Raceways Embedded in Slabs:

1. Run raceways larger than 1 inch trade size below concrete slab..
2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
3. Arrange raceways to ensure that each is surrounded by a minimum of 2 inch of concrete without voids.
4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.

E. Stub-ups to Above Recessed Ceilings:

1. Provide EMT, IMC, or ERMC for raceways.
2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
2. EMT: Provide setscrew, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

G. Expansion-Joint Fittings:

1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft.. Install in runs of aboveground ERMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft..
2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

H. Raceways Penetrating Rooms or Walls with Acoustical Requirements:

1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty.

3.4 INSTALLATION OF SURFACE RACEWAYS

A. Install surface raceways only where indicated on Drawings.

B. Install surface raceway with a minimum 2 inch radius control at bend points.

C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch mm) and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.

C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

E. Locate boxes so that cover or plate will not span different building finishes.

F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

I. Set metal floor boxes level and flush with finished floor surface.

J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION

SECTION 26 0533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface metal raceways and fittings.
2. Wireways and auxiliary gutters.

B. Related Requirements:

1. Section 260526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
2. Section 260553 "Identification for Electrical Systems" specifies warning signs referenced by this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 SURFACE METAL RACEWAYS AND FITTINGS

A. UL RJBT - Surface Metal Raceways and Fittings with Metal Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated (HBLALU4800 Series)
   b. Wiremold; Legrand North America, LLC (ALA4800 Series)

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

   a. UL CCN RJBT; including UL 5.

3. Standard Features:

   a. Aluminum base with snap-on covers.

b. Manufacturer's standard enamel finish in color selected by Architect.
c. Wiring Channels: Dual. Multiple channels must be capable of housing a standard 20 to 30 A device flush within the raceway.

2.3 WIREWAYS AND AUXILIARY GUTTERS

A. UL ZOYX - Metal Wireways and Auxiliary Gutters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB Electrification Installations Products
b. Cooper B-line; brand of Eaton, Electrical Sector
c. Hoffman; brand of nVent Electrical plc
d. Square D; Schneider Electric USA
e. Wiegmann; brand of Hubbell Electrical Solutions; Hubbell Incorporated

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. UL CCN ZOYX; including UL 870.

3. Standard Features:

a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
b. Finish: Manufacturer's standard enamel finish.

c. Wireway Covers: Hinged type unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
4. Communications Work: BICSI N1.
5. Work in Confined Spaces: NFPA 350.
6. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
7. Auxiliary Gutters: Article 366 of NFPA 70.
8. Surface Metal Raceway: Article 386 of NFPA 70.
9. Surface Nonmetallic Raceway: Article 388 of NFPA 70.
10. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install surface raceways only where indicated on Drawings.
2. Install surface raceway with a minimum **2 inch** radius control at bend points.
3. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inch** and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's published instructions. Tape and glue are unacceptable support methods.

D. Interfaces with Other Work:

1. Identification: Provide labels for surface raceways and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Provide warning signs.

3.2 FIELD QUALITY CONTROL OF SURFACE RACEWAYS

A. Administrant for Electrical Power Tests and Inspections:

1. Administer and perform tests and inspections.

B. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Perform tests and inspections recommended by standards listed in "Reference Standards for Installation" Paragraph.

C. Nonconforming Work:

1. Boxes and covers will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.3 CLEANING

A. Remove construction dust and debris from surface raceways before installing covers.

3.4 PROTECTION

A. After installation, protect surface raceways from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 0543
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type ERMC-S raceways, elbows, couplings, and nipples.
2. Type PVC raceways and fittings.
3. Fittings for conduit, tubing, and cable.
4. Solvent cements.
5. Duct accessories.
6. Handholes and boxes for exterior underground wiring.
7. Duct sealing.

B. Related Requirements:

1. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" specifies nonmetallic underground conduit with conductors (Type NUCC).
2. Section 260553 "Identification for Electrical Systems" specifies underground-line warning tape and concrete cable routing markers (warning planks).

1.2 DEFINITIONS

A. Duct: A single raceway or multiple raceways, installed singly or as components of a duct bank.

B. Duct Bank: Two or more ducts installed in parallel, direct buried or with additional casing materials such as concrete.

C. Handhole: An underground chamber containing electrical cables, sized such that personnel are not required to enter in order to access the cables.

D. Manhole: An underground chamber containing electrical cables and equipment, sized to provide access with working space clearances.

E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Coordination Meeting(s): For underground ducts and raceways. Conduct meeting(s) at Project site before excavation.

1. Attendees: Installers, fabricators, representatives of manufacturers, and administrants for field tests and inspections. Notify Architect, Construction Manager of scheduled meeting dates.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For concrete and steel used in precast concrete handholes, also include product certificates as

required by ASTM C858.

B. Shop Drawings:

1. Electric Utility Duct Banks and Structures:

a. Include plans, elevations, sections, and details, including attachments to other Work.
b. Indicate locations of private property boundaries and utility easements.
c. Include information required for approval by electric utility and for obtaining public space utility work permits.

2. Precast or Factory-Fabricated Concrete Structures:

a. Include plans, elevations, sections, and details, including attachments to other Work.
b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
c. Include reinforcement details.
d. Include frame and cover design and manhole chimneys.
e. Include grounding details.
f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, sumps, and other accessories.
g. Include joint details.

3. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes, and methods and materials for waterproofing duct entry locations.
c. Include cover design.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and other accessories.

C. Field quality-control reports.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

B. Field Reports:

1. Factory Test Reports: For handholes and boxes.
2. Manufacturer's field reports for field quality-control support.

PART 2 - PRODUCTS

2.1 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. General Characteristics: UL 6 and UL CCN DYIX.

B. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; Atkore International
b. Calconduit; Atkore International
c. Crouse-Hinds; brand of Eaton, Electrical Sector
d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated
e. Wheatland Tube; Zekelman Industries

2. Exterior Coating: Zinc.
3. Options:

a. Interior Coating: Zinc with organic top coating.
b. Minimum Trade Size: Metric designator 16 (trade size 1/2).

c. Colors: As indicated on Drawings.

2.2 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651 and UL CCN DZYR.

B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB Electrification Installations Products
b. Calconduit; Atkore International
c. JM Eagle
d. Topaz Lighting & Electric

2. Dimensional Specifications: Schedule 40.
3. Options:

a. Minimum Trade Size: Metric designator 16 (trade size 1/2).
b. Markings: For use with maximum 90 deg C wire.

2.3 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Metallic Fittings for Type ERMC, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB Electrification Installations Products
    b. Appleton; Emerson Electric Co., Automation Solutions
    c. Crouse-Hinds; brand of Eaton, Electrical Sector
    d. Konkore Fittings; Atkore International
    e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group
    f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated
    g. Southwire Company, LLC
    h. Topaz Lighting & Electric

2. General Characteristics: UL 514B and UL CCN DWTT.
3. Options:

    a. Material: Steel.
    b. Coupling Method: Raintight compression coupling with distinctive color gland nut.
    c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
    d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.4 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL CCN DWTT.

2.5 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB Electrification Installations Products
    b. Allied Tube & Conduit; Atkore International
    c. Cantex Inc.
    d. PenCell Plastics; brand of Hubbell Utility Solutions; Hubbell Incorporated

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:

    a. ASTM C858 for design and manufacturing processes.
    b. SCTE 77.

B. Handholes and Boxes other than Precast Concrete

1. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

   a. Color: Green.
   b. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
   c. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   d. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   e. Cover Legend: Molded lettering, "ELECTRIC."
   f. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
   g. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   h. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Armorcast Products Company.
      2) Carson Industries LLC.
      3) NewBasis.
      4) Quazite: Hubbell Power System, Inc.

C. Precast Concrete Handholes and Boxes:

1. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover must form top of enclosure and must have load rating consistent with that of handhole or box.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Oldcastle Infrastructure Inc.; CRH Americas
   b. Smith-Midland Corporation
   c. Utility Concrete Products, LLC

3. Configuration: Units must be designed for flush burial.
4. Frame and Cover:

   a. Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

b. Cover Finish: Nonskid finish must have minimum coefficient of friction of 0.50.
c. Cover Legend: Molded lettering, "ELECTRIC".

5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

a. Extension must provide increased depth of 12 inch.
b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

6. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.

7. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional **12 inch** vertically and horizontally to accommodate alignment variations.

a. Center window location.
b. Knockout panels must be located no less than **6 inch** from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
c. Knockout panel opening must have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
d. Knockout panels must be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
e. Knockout panels must be **1-1/2 to 2 inch** thick.

8. Handholes 12 inch wide by 24 inch long and larger must have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.7 DUCT SEALING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Electrification Installations Products
2. Gardner Bender; brand of ECM Industries LLC; division of nVent Electric plc
3. Ideal Industries, Inc.
4. NSi Industries LLC

B. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as **35 deg F**. Compound must be capable of withstanding temperature of **300 deg F** without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.

C. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

2.8 SOURCE QUALITY CONTROL

A. Factory Tests for Handholes and Boxes:

1. Factory Tests and Inspections: Perform the following tests and inspections on handholes and boxes, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, before delivering to site. Affix label with name and date of manufacturer's certification of system compliance.

    a. Precast Concrete Utility Structures: Test and inspect in accordance with ASTM C1037.
    b. Polymer Concrete and Nonconcrete Handhole and Pull-Box Prototypes: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests must be for specified tier ratings of products supplied. Testing machine pressure gages must have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

2. Nonconforming Work:

    a. Equipment that does not pass tests and inspections will be considered defective.

3. Factory Test Reports: Prepare and submit factory test and inspection reports.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain in accordance with Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication in accordance with Section 311000 "Site Clearing."

3.2 SELECTION OF UNDERGROUND DUCTS

A. Duct for Electrical Feeders 600 V and Less: PVC-40, direct buried unless otherwise indicated.

B. Duct for Electrical Branch Circuits: PVC-40, direct buried unless otherwise indicated.

C. Underground Ducts Crossing Paved Paths Walks and Driveways: PVC-40 encased in reinforced concrete.

D. Stub-ups: Concrete encased, PVC-40.

3.3 SELECTION OF UNDERGROUND ENCLOSURES

A. Handholes and Boxes:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-20 structural load rating.

2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
3. Units in Sidewalk and Similar Applications with Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
4. Cover design load must not exceed load rating of handhole or box.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Restore area after construction vehicle traffic in immediate area is complete.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

E. Cut and patch existing pavement in path of underground duct, duct bank, and underground structures in accordance with "Cutting and Patching" Article in Section 017300 "Execution."

3.5 INSTALLATION OF DUCTS AND DUCT BANKS

A. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
2. Steel raceway, bends, and fittings in single duct run or duct bank must be of same type.
3. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.

4. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.
5. Install expansion fitting near center of straight line duct with calculated expansion of more than **3/4 inch**.

6. Curves and Bends:

   a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch, both horizontally and vertically, at other locations unless otherwise indicated.
   b. Field bending must be in accordance with NFPA 70 minimum radii requirements, except

bends over 45 degrees must be made with minimum radius of 48 inch. Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.

c. Duct must have maximum of 180 degrees of bends between pull points.

7. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum **3 inch** of concrete for minimum of **12 inch** on each side of coupling.

   a. Install insulated grounding bushings on steel raceway terminations that are less than **12 inch** below grade or floor level and do not terminate in hubs.

8. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing duct will not be subject to environmental temperatures above **104 deg F**. Where environmental temperatures are calculated to rise above **104 deg F**, and anywhere duct crosses above underground steam line, install insulation blankets listed for direct burial to isolate duct bank from steam line to maintain maximum environmental temperature of **104 deg F**.

9. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately **10 inch** o.c. for **5 inch** duct, and vary proportionately for other duct sizes.

   a. Begin change from regular spacing to end-bell spacing **10 ft** from end bell, without reducing duct slope and without forming trap in line.
   b. Grout end bells into structure walls from both sides to provide watertight entrances.

10. Building Wall Penetrations: Make transition from underground duct to steel raceway at least **10 ft** outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
11. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

    a. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum **3 inch** of concrete for minimum of **12 inch** on each side of coupling.

12. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least **15 psig** hydrostatic pressure.
13. Pulling Cord: Install **200 lbf** test nylon cord in empty ducts.

14. Concrete-Encased Ducts and Duct Bank:

    a. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes **6 inch** or less in nominal diameter.

    b. Width: Excavate trench 3 inch wider than duct on each side.
    c. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

d. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less thanfive spacers per **20 ft** of duct. Place spacers within **24 inch** of duct ends. Stagger spacers approximately **6 inch** between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

e. Minimum Space between Ducts: **3 inch** between edge of duct and exterior envelope wall, **2 inch** between ducts for like services, and **4 inch** between power and communications ducts.

f. Elbows:

1) Use manufactured duct elbows for stub-ups and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
2) Use manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct run.

g. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

h. Concrete Cover: Install minimum of **3 inch** of concrete cover between edge of duct to exterior envelope wall, **2 inch** between duct of like services, and **4 inch** between power and communications ducts.

i. Place minimum **6 inch** of engineered fill above concrete encasement of duct.

j. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

1) Start at one end and finish at other, allowing for expansion and contraction of duct as its temperature changes during and after pour. Use expansion fittings installed in accordance with manufacturer's published instructions, or use other specific measures to prevent expansion-contraction damage.
2) If more than one pour is necessary, terminate each pour in vertical plane and install **3/4 inch** reinforcing-rod dowels extending minimum of **18 inch** into concrete on both sides of joint near corners of envelope.

k. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

15. Direct-Buried Duct and Duct Bank:

a. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than **6 inch** in nominal diameter.

b. Width: Excavate trench 3 inch wider than duct on each side.

c. Set elevation of top of duct bank below frost line.

d. Place minimum **3 inch** of sand as bed for duct. Place sand to minimum of **6 inch** above top level of duct.

e. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

f. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less thanfive spacers per **20 ft** of duct. Place spacers within **24 inch** of duct ends. Stagger spacers approximately **6 inch** between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

g. Install duct with minimum of **3 inch** between ducts for like services and **6 inch** between power and communications duct.

h. Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

i. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to **4 inch** over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

16. Underground-Line Warning Tape: Bury nonconducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than **12 inch** above concrete-encased duct and duct banks and approximately 12 inch below grade. Align tape parallel to and within **3 inch** of centerline of duct bank. Provide additional warning tape for each **12 inch** increment of duct-bank width over nominal **18 inch**. Space additional tapes **12 inch** apart, horizontally across width of ducts.
17. Ground ducts and duct banks in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.7 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Reference Standards:

1. Precast Concrete Handholes: Comply with ASTM C891 unless otherwise indicated.
2. Consult Architect for resolution of conflicting requirements.

B. Special Techniques:

1. Precast Concrete Handholes and Manholes:

   a. Install units level and plumb and with orientation and depth coordinated with connecting duct to minimize bends and deflections required for proper entrances.
   b. Unless otherwise indicated, support units on level bed of crushed stone or gravel graded from **1 inch** sieve to **No. 4** sieve and compacted to same density as adjacent undisturbed earth.
   c. Field-cut openings for conduits in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

2. Elevations:

   a. Install handholes with bottom below frost line.
   b. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes **1 inch** above finished grade.
   c. Where indicated, cast handhole cover frame integrally with handhole structure.

3. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

4. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
5. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than **3-7/8 inch** for manholes and **2 inch** for handholes, for anchor bolts installed in field. Use minimum of two anchors for each cable stanchion.
6. Ground manholes, handholes, and boxes in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum **12 inch** long mandrel equal to duct size minus **1/4 inch**. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and

Bonding for Electrical Systems."

B. Nonconforming Work:

1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
2. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.9 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump, and building interiors affected by Work.

1. Sweep floor, removing dirt and debris.
2. Remove foreign material.

END OF SECTION

SECTION 26 0544
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeve-seal systems.
2. Grout.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, LLC
2. CALPICO, Inc.
3. Flexicraft Industries
4. Metraflex Company (The)

B. General Characteristics: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

C. Options:

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.2 GROUT

A. General Characteristics: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: **5000 psi**, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

    a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
    b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

C. Underground, Exterior-Wall and Floor Penetrations:

1. Install steel pipe sleeves. Size sleeves to allow for **1 inch** annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.
    d. Neutral: White.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.
    d. Neutral: Gray

4. Color for Equipment Grounds: Green.
5. Colors for Isolated Grounds: Green two or more yellow stripes.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

E. Equipment Identification Labels:

1. Black letters on a white field.
2. Panelboards shall be labeled with their name, voltage, phase, main & bus ampacities, and where they are fed from panelboard or switchboard name and position.
3. Transformers shall be labeled with their name, voltages, phase, kVA rating, and where they are fed from panelboard or switchboard name and position, what panelboard or switchboard they feed.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors.
b. 3-1/2 by 5 inches for equipment.
c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 TAGS

A. Write-on Tags:

1. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:

1.

2. Preprinted aluminum signs,punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

    a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    b. For signs larger than 20 sq. in., 1/8 inch thick.
    c. Engraved legend with white letters on a dark gray background.
    d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Vinyl Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

L. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

M. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

N. Self-Adhesive Labels:

1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

Q. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

R. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

U. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

V. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

W. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

X. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

Y. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

Z. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.

F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.

G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

H. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

I. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

K. Operating Instruction Signs: Self-adhesive labels.

L. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION

SECTION 26 2416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for SPD as installed in panelboard.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 24 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

E. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

F. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

G. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.

Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: As indicated on drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: As indicated on drawings.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Electronic Trip Circuit Breakers:

a. RMS sensing.
b. Field-replaceable rating plug or electronic trip.
c. Digital display of settings, trip targets, and indicated metering displays.
d. Multi-button keypad to access programmable functions and monitored data.
e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
f. Integral test jack for connection to portable test set or laptop computer.
g. Field-Adjustable Settings:
1) Long- and short-time pickup levels.
2) Long and short time adjustments.
3) Ground-fault pickup level, time delay, and I squared T response.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. Subfeed Circuit Breakers: Vertically mounted.
8. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NEMA PB 1.1.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box.

E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

H. Install filler plates in unused spaces.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. General-grade single straight-blade receptacles.
3. General-grade duplex straight-blade receptacles.
4. Receptacles with arc-fault and ground-fault protective devices.

B. Related Requirements:

1. Section 26 0526 "Grounding and Bonding for Electrical Systems" specifies grounding and bonding referenced by this Section.
2. Section 26 0533.16 "Boxes and Covers for Electrical Systems" specifies covers and cover plates referenced by this Section.
3. Section 26 0553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs referenced by this Section.

1.2 DEFINITIONS

A. AFCI: Arc-Fault Circuit Interrupter.

B. Commercial/Industrial-Use Cord Reel: A cord reel subject to severe use in factories, commercial garages, construction sites, and similar locations requiring a harder service-type cord.

C. GFCI: Ground-Fault Circuit Interrupter.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

a. If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
b. Listing criteria identified in approval letter must match specified listing criteria. UL label indicating approval of equipment's enclosure is not considered approval of equipment for intended application.
c. Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for discontinued or superseded products are not acceptable for submitted product.

B. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's published instructions.

B. Field Reports:

1. Manufacturer's field reports for field quality-control support.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra stock material.

B. Special tools.

1.7 WARRANTY FOR DEVICES

A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.

1. Initial Extended Warranty Period: Three years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Eaton, Wiring Devices; Arrow Hart

b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
c. Pass & Seymour; Legrand North America, LLC

2. Source Limitations: Obtain products from single manufacturer.
3. Listing Criteria: UL CCN WMUZ and UL 20.
4. Standard Features:

a. Device Color: White.
b. Configuration:

1) General-duty, 120-277 V, 15 A, single pole.
2) General-duty, 120-277 V, 20 A, single pole.
3) Extra-heavy-duty, 120-277 V, 15 A, single pole.
4) Extra-heavy-duty, 120-277 V, 20 A, single pole.
5) Extra-heavy-duty, 120-277 V, 30 A, double pole.

5. Accessories:

a. Cover Plate: **0.060 inch** thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.3 GENERAL-GRADE SINGLE STRAIGHT-BLADE RECEPTACLES

A. Single Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Eaton, Wiring Devices; Arrow Hart
b. Pass & Seymour; Legrand North America, LLC
c. Insert Manufacturers Name

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.

3. Standard Features:

a. Device Color: White.
b. Configuration:

1) Extra-heavy-duty, NEMA 5-20R.
2) Extra-heavy-duty, NEMA 6-30R.

4. Other Available Features Required by the Project:

a. Has factory-terminated connectors on wiring device pigtails for quick installation.

5. Accessories:

a. Cover Plate: **0.060 inch** thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.4 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

A. Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Eaton, Wiring Devices; Arrow Hart
b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
c. Pass & Seymour; Legrand North America, LLC

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
b. Surge Protective Devices: UL 1449, Type 3.

3. Standard Features:

a. Device Color: White.
b. Configuration:

1) General-duty, NEMA 5-15R.
2) General-duty, smooth face, NEMA 5-15R.

4. Other Available Features Required by the Project:

a. Has factory-terminated connectors on wiring device pigtails for quick installation.

5. Accessories:

a. Cover Plate: **0.060 inch** thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. Tamper-Resistant Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Eaton, Wiring Devices; Arrow Hart
b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
c. Pass & Seymour; Legrand North America, LLC

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product

categories:

a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
b. Surge Protective Devices: UL 1449, Type 3.

3. Standard Features:

a. Device Color: White.
b. Configuration:

1) General-duty, NEMA 5-15R.
2) General-duty, smooth face, NEMA 5-15R.

4. Other Available Features Required by the Project:

a. Has factory-terminated connectors on wiring device pigtails for quick installation.

5. Accessories:

a. Cover Plate: **0.060 inch** thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

C. Isolated Ground Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Eaton, Wiring Devices; Arrow Hart
b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
c. Pass & Seymour; Legrand North America, LLC

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. Receptacles for Plugs and Attachment Plugs: UL CCN RTRT and UL 498.
b. Surge Protective Devices: UL 1449, Type 3.

3. Standard Features:

a. Device Color: Orange.
b. Configuration:

1) General-duty, NEMA 5-15R.
2) General-duty, smooth face, NEMA 5-15R.

4. Other Available Features Required by the Project:

a. Has factory-terminated connectors on wiring device pigtails for quick installation.

5. Accessories:

a. Cover Plate: **0.060 inch** thick, high-impact thermoplastic (nylon) with smooth finish and white color; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.5 RECEPTACLES WITH ARC-FAULT AND GROUND-FAULT PROTECTIVE DEVICES

A. General-Grade, Weather-Resistant, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Eaton, Wiring Devices; Arrow Hart
b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated
c. Pass & Seymour; Legrand North America, LLC

2. Listing Criteria: Investigated, labeled, and marked by qualified electrical testing laboratory in accordance with guide information and standards specified for the following UL product categories:

a. Receptacle GFCIs: UL CCN KCXS, UL 498, and UL 943.

3. Standard Features:

a. Device Color: White.
b. Configuration: Heavy-duty, NEMA 5-15R.

4. Other Available Features Required by the Project:

a. Has factory-terminated connectors on wiring device pigtails for quick installation.

5. Accessories:

a. Cover Plate: **0.060 inch** thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.6 MAINTENANCE MATERIAL ITEMS FOR STRAIGHT-BLADE RECEPTACLES

A. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to controlled receptacles, that are packaged with protective covering for storage on-site and identified with labels describing contents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receptacles:

1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 SELECTION OF GFCI RECEPTACLES

A. Healthcare Facilities: Unless protection of downstream branch-circuit wiring, cord sets, and power-supply cords is required by NFPA 70 or NFPA 99, provide non-feed-through GFCI receptacles.

3.3 INSTALLATION OF SWITCHES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Life Safety and Means of Egress Work: NFPA 101.
4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
5. Wiring Devices: NECA NEIS 130.
6. Mounting Heights: NECA NEIS 1.
7. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:

1. Identification:

a. Identify cover or cover plate for device with panelboard identification and circuit number.
b. Mark cover or cover plate using hot, stamped, or engraved machine printing with [**black**][**white**][**red**]-filled lettering, and provide durable wire markers or tags inside device box or outlet box.
c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.
d. Healthcare Facilities: Distinctively identify covers or cover plates of device boxes and outlet boxes that are supplied from life safety and critical branch power supplies following facility's standard practice.

3.4 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in the Contract Documents or manufacturer's published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Electrical Safety: NFPA 70E.
3. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
4. Work in ITE Rooms: NFPA 75.
5. Work in Confined Spaces: NFPA 350.
6. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
7. Installing and Maintaining Wiring Devices: NECA NEIS 130.
8. Mounting Heights: Unless otherwise indicated in the Contract Documents, comply with mounting

heights recommended in NECA NEIS 1.

9. Receptacle Orientation: Unless otherwise indicated in the Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
10. Consult Architect for resolution of conflicting requirements.

C. Interfaces with Other Work:

1. Identification: Provide labels for receptacles and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Label each enclosure with self-adhesive labels.

1) Identify cover or cover plate for device with panelboard identification and circuit number.
2) Mark cover or cover plate using hot, stamped, or engraved machine printing with black-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

c. Provide warning signs and arc-flash hazard warning labels for electrical equipment.

3.5 FIELD QUALITY CONTROL OF SWITCHES

A. Administrant for Electrical Power Tests and Inspections:

1. Administer and perform tests and inspections.

B. Tests and Inspections:

1. Perform tests and inspections in accordance with manufacturers' published instructions.

C. Nonconforming Work:

1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.6 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

A. Administrant for Electrical Power Tests and Inspections:

1. Administer and perform tests and inspections.

B. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.
2. Verify polarity of hot and neutral pins.
3. Measure line voltage.
4. Measure percent voltage drop.
5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' published instructions.

C. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.7 SYSTEM STARTUP FOR SWITCHES

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.

3.8 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Enclosures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

2.3 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.

3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated. combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations.

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 75 deg C rated wire.

G. Standards: Comply with UL 489 with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Long- and short-time pickup levels.
2. Long- and short-time time adjustments.
3. Ground-fault pickup level, time delay, and I-squared t response.

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R, 12).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.2 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

F. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 0573.16 "Coordination Studies."

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
e. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit

battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.

i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 27 1000
STRUCTURED CABLING FOR VOICE AND DATA

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Copper cable and terminations.

B. Fiber optic cable and interconnecting devices.

C. Communications and Data equipment room fittings.

D. Communications and Data outlets.

E. Communications and Data identification.

1.3 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0535 - Surface Raceways

1.4 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

B. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Revision E, 2005.

C. ICEA S-83-596 - Indoor Optical Fiber Cables; 2016.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).

F. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

G. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; 2015c.

H. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2018.

I. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2016d.

J. TIA-569 - Telecommunications Pathways and Spaces; 2015d, with Addendum (2016).

K. TIA-598 - Optical Fiber Cable Color Coding; 2014d.

L. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2017c.

M. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2015c, with Addendum (2017).

N. UL 444 - Communications Cables; Current Edition, Including All Revisions.

O. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.

2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Notify Fuller and D'Angelo, P.C. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section to review connection requirements and details with Owner's representative.

1.6 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Evidence of qualifications for installer.

D. Field Test Reports.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:

1. Supervisors and installers factory certified by manufacturers of products to be installed.

2. Employing BICSI Registered Cabling Installation Technicians (RCIT) for supervision of all work.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

PART 2 PRODUCTS

2.1 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Fiber Optic Backbone Cable:

1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, TIA-598, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.

2. Cable Type: Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC.

3. Cable Capacity: Quantity of fibers as indicated on drawings.

4. Cable Applications:

a. Plenum Applications: Use listed NFPA 70 Type OFNP plenum cable.

B. Fiber Optic Interconnecting Devices:

1. Connector Type: Type LC.

2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.

3. Maximum Attenuation/Insertion Loss: 0.3 dB.

2.2 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:

1. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.

a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.

b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.

c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.

d. Provide incoming cable strain relief and routing guides on back of panel.

e. Mount in existing rack. Verify compatibility.

f. Provide seperate patch panel for each wire category. (ie; data, phone, etc..)

2. Product(s):

B. Fiber Optic Cross-Connection Equipment:

1. Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum.

    a. Adapters: As specified above under FIBER OPTIC CABLE AND INTERCONNECTING DEVICES; maximum of 24 duplex adaptors per standard panel width.

    b. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.

    c. Provide incoming cable strain relief and routing guides on back of panel.

    d. Provide rear cable management tray at least 8 inches deep with removable cover.

    e. Provide dust covers for unused adapters.

C. Cable Tray:

1. Aliminum Ladder Type

2. Provide at each data closet from cable entry location to top of data racks.

2.3 COMMUNICATIONS OUTLETS

A. Mounting Brackets: Provide at all recessed installations in gypsum board walls.

1. Flush mounting with screw set clamping ears. Size to match faceplates/

B. Outlet Boxes: Comply with Section 26 0535. for surface mounted installations in finished spaces

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

2. Minimum Size, Unless Otherwise Indicated:

    a. Voice / Data Outlets: 4 inch by 2 inch by 2-1/8 inch deep (100 by 50 by 54 mm) trade size.

C. Wall Plates:

1. Comply with system design standards and UL 514C.

2. Accepts modular jacks/inserts.

3. Capacity:

4. Wall Plate Material/Finish - Flush-Mounted Outlets: High impact thermoplastic, color to be selected.

2.4 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

B. Coordinate with district to match existing labeling requirements.

2.5 SOURCE QUALITY CONTROL

A. Factory test cables according to TIA-568 (SET).

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

3.2 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:

1. 12 inches from power conduits and cables and panelboards.

2. 5 inches from fluorescent and high frequency lighting fixtures.

3. 6 inches from flues, hot water pipes, and steam pipes.

B. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 26 0533.16as required for installation of telecommunications outlets provided under this section.

2. Coordinate location of all outlet boxes, brackets and devices with Owner's representative.

a. Mounting Heights: Unless otherwise indicated, as follows:

a) Data Outlets: 18 inches above finished floor.

b) Telephone Outlets for Wall-Mounted Telephones: 54 inches above finished floor to top of telephone.

b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3.3 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.

2. Do not over-cinch or crush cables.

3. Do not exceed manufacturer's recommended cable pull tension.

4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Cable Supports:

1. Properly support all cables. Do not allow cables to lay on existing ceiling. Do not use ceiling structure for support.

2. Provide spring clips, attached to building structure for individual cable support.

3. Provide J-Hook, attached to building structure or adjacent wall above suspended ceilings for support of ware bundles.

4. Provide support devices every 10' maximum.

C. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

1. At Outlets - Copper: 12 inches.

D. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.

2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.

3. Use T568A wiring configuration.

E. Fiber Optic Cabling:

1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.

2. Support vertical cable at intervals as recommended by manufacturer.

F. Identification:

1. Use wire and cable markers to identify cables at each end.

2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.

3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

4. Coordinate all labeling with Owner's representative to match existing labeling convention.

3.4 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:

1. Inspect cable jackets for certification markings.

2. Inspect cable terminations for color coded labels of proper type.

3. Inspect outlet plates and patch panels for complete labels.

C. Testing - Copper Cabling and Associated Equipment:

1. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

D. Testing - Fiber Optic Cabling:

1. Multimode Backbone: Perform tests in accordance with TIA-526-14.

2. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.

SECTION 27 0500
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section is intended to describe the basic materials and installation methods for electrical work; it applies in general to all Sections under DIVISION 27. All materials and equipment specified and/or shown on Drawings are new unless noted otherwise.

B. All new materials, equipment and systems shall be listed and labeled by a licensed nationally recognized testing laboratory as defined by OSHA and used for the specific purpose, environment or application for which it was tested and approved. No field modifications and/or noncompliant installation whatsoever shall be made to any materials, equipment and systems that would violate the listing and labeling.

C. This section includes the following:

1. Communications equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Fire-Rated Cable Pathways
6. Common communications installation requirements.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. EPDM: Ethylene-propylene-diene terpolymer rubber.

G. NBR: Acrylonitrile-butadiene rubber.

1.4 REFERENCES

A. Provide work in accordance with all applicable international, state and local, codes, rules, regulations, and standards, including but not limited to, requirements of the following:

1. Underwriters' Laboratories, Inc. (UL).
2. National Electrical Manufacturer's Association (NEMA).
3. National Electrical Contractors Association (NECA)
4. The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
5. Applicable NFPA Codes and Standards
6. American National Standards Institute (ANSI)
7. Code of Federal Regulations (CFR)
8. Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual, Latest Edition
9. Telecommunication Industries Association/Electronic Industries Alliance / (TIA/EIA)

B. The following standards are referenced to establish a base level of quality and conformance with industry standards. These specifications and the contract drawings shall take precedence over any document listed below.

1. Lucent Systimax PDS, Fiber Installation Manual

C. Conflicts

1. Nothing stated or shown in Specifications or on Drawings is intended to conflict with the above standards and regulations. Should Contractor find any apparent conflict, it shall be his responsibility to notify Architect before any of the work in question is performed or material purchased.

1.5 SUBMITTALS

A. Provide Product List of factory fabricated items, in accordance with Section 016000 “Product Requirements”, including name of proposed manufacturer, for all products specified in various sections of Division 27.

B. Provide submittals in accordance with Section 013300 “Submittal Procedures” in sufficient detail to verify full compliance with the requirements of the Contract Documents.

C. Product Data: Provide for each type of factory-fabricated product indicated.

D. Submit testing reports.

1.6 WARRANTY AND CONTRACT CLOSEOUT

A. Comply with warranty and contract closeout requirements specified in Division 01, GENERAL REQUIREMENTS.

B. Provide Special Warranties and/or warranty service in accordance with Section 016000 “Product Requirements” where specified in the various sections of Division 27 and as indicated below.

1. Warranty - Communications cabling systems shall be guaranteed in writing against defects in workmanship and defective materials for a period of one (1) year after acceptance by the Owner. During this time, communications cabling systems shall be kept in proper operating condition at no additional cost to the Owner.

2. Service - Provide one (1) year service contract on all communications cabling system components and equipment. Contract shall be based on 8 hours service and preventative maintenance per month.

3. All associated hardware and labor shall have a manufacturer and/or supplier's warranty for a minimum period of fifteen (15) years from the date of acceptance by the Owner. This warranty must guarantee channel and link performance parameters that meet or exceed those specified in EIA/TIA 568-B.2-1 and offer an assurance for any application that is designed to operate on Category 6 UTP cable. This is to include the replacement of any defective components provided as part of this project at no cost to the Owner for either parts or labor.

   a. Provide manufacturer’s certificates of supervision and startup service as specified in the various sections of Division 27.

   b. Upon completion of work and tests, and at a time mutually agreed to by Contractor, Architect and Owner, operate all systems installed, in all parts, at Contractor's expense for sufficient length of time to demonstrate the mode of operation and definitely determine whether systems as a whole are in first class working condition. Defects and malfunctions that may develop during this period of operation shall be immediately corrected by Contractor at his own expense, and systems placed in first class working condition before being finally turned over to Owner.

   c. Include information for all products specified in the operation and maintenance manual.

   d. Provide electrical certificate(s) from electrical inspection agency - see Article titled “Inspections”.

   e. Provide manufacturer's certification and warranty of system operation - see Article titled “Tests”.

1.7 QUALITY ASSURANCE

A. The specifications for certain products and alternative materials may appear in more than one section of Division 27. Work of Division 27 shall be coordinated for all sections of Division 27 to assure that where

two or more items of any given product are furnished under Division 27 that they are of the same manufacturer and type and that alternative materials is consistent throughout the work of Division 27.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle all material and equipment in accordance with manufacturer's instructions and recommendations. Such instructions and recommendations are hereby made part of these specifications.

B. Deliver products and equipment properly labeled and tagged. Maintain products in original shipping containers and store in a dry area until ready for installation.

C. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.9 INSPECTIONS

A. Before starting any Work under this Contract, file for inspection with the agency approved by the AHJ. Upon completion of the work, furnish electrical certificates from said agency for all electrical equipment and systems installed or furnished and installed as part of the work.

B. Communications equipment or systems that are modified in the field shall be reinspected. Furnish a new electrical certificate covering such modifications.

1.10 COORDINATION

A. The communications systems are indicated on the Communications Drawings. Certain pertinent information and details required by the communications work appear on the Architectural, Structural and Mechanical Drawings. Become familiar with all drawings and incorporate all pertinent requirements

B. Drawings are diagrammatic and indicate general arrangement of systems and requirements of the Communications work. Do not scale the drawings to obtain dimensional requirements. Exact locations of equipment must be coordinated and obtained prior to starting the work.

C. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

    a. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

    b. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

c. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

1.11 EQUIPMENT LOCATIONS

A. Locations are subject to changes in order to avoid obstacles in building construction. Verify all dimensions and conditions at site. Check layout for sizes and clearances, so that the apparatus and material may be installed and operated satisfactorily in space provided. Install equipment and raceways to preserve headroom and to keep openings and passageways clear.

B. Install equipment, boxes and outlets in accessible locations. Obtain final locations of all outlets and equipment from details on drawings and from Architect. Examine drawings of other trades and avoid interferences with their work.

C. In case of conflict in location of flush outlets, architectural details shall take precedence.

D. Install conduit to avoid mechanical and/or structural obstructions, minimizing crossovers.

E. Install all exposed conduits parallel or perpendicular to building lines.

F. Provide minimum of 6 inches clearance between communications work and electrical work, flues, steam pipes and other heat sources.

G. Mounting heights of outlets and equipment shall be as indicated on "Mounting Height" Schedule, or as specified herein.

H. Verify all door swings before installing switch boxes. In case of conflict between drawings, Architectural details shall take precedence.

I. Architect reserves the right to change, without additional cost, location of any communications outlet, provided such changed location is not more than 10 feet, and is ordered changed before said work is completely "roughed in".

J. Locations of communications equipment and connections to all other equipment are approximately correct, and are subject to such modifications as are required at time of installation, in order to meet field conditions or the dimensions of equipment actually being supplied.

K. No changes are to be made in the original design without written approval by Architect.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements,

2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

a) Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.

2.3 FIRE-RATED CABLE PATHWAY

2.4 All telecommunications cable bundles shall utilize an enclosed fire-rated pathway device wherever said cables penetrate rated walls. The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall firestop materials. The pathway shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479).

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:

1. STI, Inc., EZ-Path

2. Wiremold

C. Cable pathway shall have an orange finish color and dimensions of 3 inches wide by 3 inches high by

1. 10.5 inches long.

D. Multiple cable pathways shall be installed in rated partitions utilizing manufacturer's recommended wall plate.

E. Cable pathway shall meet or exceed rating of partition where pathway is installed. Refer to architectural drawings for rating of partitions.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. General

1. Comply with NECA 1.

2. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

3. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

4. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

5. Right of Way: Give to piping systems installed at a required slope.

6. Furnish, deliver, erect, connect and finish in every detail, all materials, equipment and accessories required for the Work. Select and arrange to fit properly into the building spaces.

7. Perform all work in accordance with the drawings, specifications, including manufacturer's installation instructions, all applicable codes and NECA's Standard of Installation guidelines.

8. Include in the Work and in the bid proposal minor details not shown or specified, but manifestly necessary for the proper installation and operation of the various systems, as if specified or shown.

9. Position and install all material and equipment to permit proper access and in such a manner that maintenance, adjustment, calibration, inspection, repair and replacement of the material and equipment can be accomplished with minimum effort and cost.

10. Perform the installation, wiring, cleaning, testing, calibration and startup of all material and equipment in accordance with the manufacturers' instructions and recommendations. Such instructions and recommendations are hereby made a part of these Specifications.

11. If any departures from Contract Documents are deemed necessary, submit details of such departures and the reasons there for to Architect for approval.

12. Pull and junction boxes shall be located and sized by electrical contractor in accordance with NEC, EIA/TIA, utility company requirements and Owner standards, unless otherwise noted on the drawings.

B. Layout and Coordination

1. Lay out all work from approved building and property lines and benchmarks. Verify and be responsible for the correctness of all measurements in connection with work. Any change made in major overall dimensions as shown which affect the physical size, shape, or location of any part of the Work, whether due to field check or changes due to the use of equipment of a manufacturer other than that used as the basis of design shall not cause any interference with other work.

2. Examine the drawings of other trades and initiate cooperation and coordination of the Work with the work of other trades to insure that the Work can be installed properly as designed and planned without interference with other work or delay. Furnish all necessary templates, patterns, measurements, etc., for installing work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

3. Investigate the structural and finish conditions affecting the Work. Offsets, bends or other items required by the Work may not be shown due to the small scale of the drawings; provide such offsets, bends or other items as required to meet structural or finish conditions.

4. Coordinate and be responsible for the required clearances of the Work in shafts, chases, double partitions and suspended ceilings. Coordinate and cooperate with the trades responsible for constructing such spaces, together with other trades sharing such spaces, and advise other trades of the requirements of the Work. Immediately submit for review space requirements that exceed those shown.

5. Install material and equipment as high as possible; at minimum, to clear the top of all doors, windows and other structural openings. Maintain maximum headroom and space conditions in every case. Where headroom or space conditions appear inadequate, notify the Architect before proceeding with the installation.

6. Install conduit, fittings, etc., to provide not less than 1/2 inch between their finished covering and the structure or adjacent work of any kind.

7. Communications equipment shall not interfere in any way with other material or equipment and shall be provided with adequate working space; see the National Electrical Code working space requirements.

8. Make reasonable modifications in the layout of the Work, as directed, to provide proper clearances or accessibility, or to prevent conflict with the work of other trades, at no increase in the Contract sum.

9. Cooperate fully with the Contractor for General Construction in regard to location of electrical equipment and work progress schedules. Notify him of all flush panelboard locations so that wall of proper thickness is provided.

10. Prepare large scale composite working drawings, including such section views and details as are necessary to clearly show how the Work is to be installed in relation to the work of other trades. Issue such drawings to the other trades for coordination of their work. Where such drawings show deviations from the Contract Drawings or conflict with other trades, detail and submit such deviation or conflicts to the Architect for review.

11. Locate wall switches at strike side of doors and at height indicated on "Mounting Height" schedule. Review all door swings with Contractor for General Construction prior to rough-in.

12. Locate receptacles at heights indicated in "Mounting Height" schedule. Mount receptacles vertically, ground pole at top. In special areas such as kitchens, laboratories, utility areas, coordinate locations with counters, benches and casework.

C. If work is installed before coordinating with all other trades and Owner's work, or so as to cause interference with the work of other trades, or so as not to provide proper access for maintenance or repair, make necessary changes in work to correct the condition at no cost to the Owner.

1. Excavation, Trenching, Backfilling

a. Mass excavation to required basic construction elevations will be performed under Division 31, EARTHWORK.

b. Provide all other excavation, trenching and backfilling including shoring, sheeting, pumping, grading, barricading and other related work necessary for installation of electrical work.

c. Perform work in accordance with the requirements of Division 31, EARTHWORK.

D. Cutting and Patching

1. Except where specified otherwise in Division 27, provide cutting, patching and refinishing work in accord with the requirements of Division 01, GENERAL REQUIREMENTS.

2. Horizontal chases shall not be cut into existing walls or partitions without approval of Architect.

E. Painting

1. Except where specified otherwise in Division 27, general painting will be provided under Division 09, FINISHES.

F. Touch up or paint out damage done to items having a factory applied finish, and which are installed under Division 27, utilizing materials and methods specified in Division 09. FINISHES.

G. Foundations

1. Provide concrete foundations required for the work specified under Division 27, unless specifically noted otherwise. Be responsible for preparing foundation drawings and setting foundation anchor bolts in time so as not to delay the work. Concrete foundations shall be of the types detailed or as specified.

2. Reinforce concrete foundations to suit the loads placed on them; foundations shall be in strict accordance with the equipment manufacturers' recommendations. Concrete materials and methods shall be as specified in Division 03, CONCRETE.

3. Unless otherwise indicated, concrete equipment pads shall be provided under all switchgear, motor control centers, substations, etc., and shall extend a minimum 4 inches above the finished floor, at least 4 inches beyond the equipment base in all directions, shall have the top edges and vertical corners chamfered and shall have the same surface finish as the adjacent and surrounding floor.

4. Securely anchor concrete foundations to the floor slab with steel dowels. When so indicated or where required, concrete foundations or concrete footings for structural steel supports for

equipment too heavy to be placed in the floor slab shall be extended not less than 12 inches below the underside of the floor slab, except where bearing rock is encountered at a lesser depth. In such cases, after inspection and approval, concrete foundations may be set on bearing rock.

5. Furnish and set, with proper templates, anchor bolts and inserts required for the proper attachment of the equipment to the concrete foundations. Anchor bolts shall be of the size and number required by the equipment or as recommended by the equipment manufacturer and shall be in accordance with the requirements detailed or specified. Anchor bolts shall also be compatible with vibration isolation requirements specified for the equipment.

6. Set equipment anchor bolts in pipe sleeves at least two sizes larger than the anchor bolt. Length of pipe sleeve shall be the same as the imbedded length of the anchor bolt. After the equipment is set in place and adjusted to its proper position, completely fill the annular space between the anchor bolt and the inside of the pipe sleeve for the full length of the pipe sleeve with Embeco, or equivalent, nonshrink cement grout.

7. Grout any openings between the top of the concrete foundation and the base of the equipment using nonshrink cement grout.

8. Piles, pile caps and foundation beams for exterior underground duct banks and for equipment foundations will be furnished under the General Construction Divisions of the Specifications.

H. Access Doors and Panels

1. Access doors and panels shown on the Architectural Drawings will be provided under Division 05, METALS.

2. Furnish other access panels required under Division 27 for installation under the General Construction Sections.

3. Furnish access panels for access to concealed junction/pull boxes, cabinets, terminal boxes and other equipment where other means of access is not available. Access panels shall be adequate in size for the service requirements, and shall not have a clear opening of less than 16 inches x 16 inches. Final size and location of access panels shall be subject to approval of the Architect. Cooperate with other trades so that the equipment will be accessible through the access panels.

4. Access panels shall be of steel construction, prime coated; have front panel fitted flush with the frame, with concealed hinge and latches; and shall be Inryco/Milcor, Style DW, K or M, to suit the construction and location.

I. Sleeves[, Fire-stops] and Waterseals

1. Provide each raceway or cable passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe with smooth edges, securely and neatly cemented in place. Provide each raceway or cable passing through a wood or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.

J. Set floor sleeves flush with floor surface in finished areas; 1 inch above the finished floor in kitchens, cafeterias and similar service areas, mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Wall and partition sleeves shall be flush with each surface unless otherwise indicated or specified.

K. Sleeves shall be 2 pipe sizes larger than the conduit or cable size unless otherwise required by the sealing method selected by the Contractor for Division 07, THERMAL AND MOISTURE PROTECTION. Coordinate with the Contractor for that section to determine requirements for sleeves, clearances, etc. Remove sleeve if required by UL listing for system selected.

L. Place sleeves in concrete floor or wall forms before concrete is poured. Sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.

M. Insure proper location and alignment of all sleeves for electrical work before and during concrete placement.

N. Where sleeves penetrate exterior walls, fill and seal ends around conduits and/or cables with duct sealant compound equal to Solorite KN-1146, or Link Seal. Install seals in accordance with the manufacturer's recommendations to provide airtightness above ground and hydrostatic sealing below grade. Caulking or other type mastic is not acceptable.

3.2 PROTECTION OF WORK

A. Protect all conduit, fittings, cabinets, racks, cable trays and other equipment before and during installation and keep clean.

B. Protect factory finished equipment and devices with approved temporary protective material where these items are subject to accidental damage or abuse. Communications equipment shall be stored indoors or otherwise securely protected and kept free of condensation by adequate electric heat. Contractor shall remove all temporary protective material at the conclusion of the Work or as directed.

C. The Contractor shall assume full responsibility for the cost of repairing or replacing any damaged Work or material caused by employees working under this Division.

3.3 TESTS

A. This article shall not be construed as deleting other tests specifically outlined in other sections of this Specification.

B. All materials and documentation to be furnished under this specification shall be subject to inspections and tests. Equipment and systems shall not be accepted until all required inspections and tests have been made, demonstrating that the equipment and systems conform to the specifications, and that all required equipment, systems, and documentation have been provided. The Owner reserves the right to request additional tests at no extra cost on any work that the Owner determines not to be in accordance with this specification.

C. The Owner shall have access to inspect the supplier/installer's quality assurance (QA) standards, procedures, and records that are applicable to this project. Inspection shall not relieve the supplier/installer of the responsibility for providing material and equipment conforming to the requirements of this specification.

D. Notify the Owner in writing of the test schedule at least two (2) weeks in advance. The test schedule shall be coordinated to permit the Design Professional to attend.

E. Twisted-Pair Media Tests - All UTP cables will be tested with equipment that meets or exceeds the requirements of TIA/EIA 568-B2 Level 2e and certified to ensure that the level of performance has been

met. The tester must be calibrated with the cable used in the project to ensure that the correct NVP is utilized. The installation contractor shall provide documented proof that each line of the horizontal

distribution system is capable of handling the required data rates. The customer may test random cables to ensure that they meet the documented test results provided. The installation contractor is responsible for correcting or reinstalling all systems that fail to perform to specification. The following is a summation of the tests that should be performed on a UTP cabling plant, basic link configuration. If any test indicates a lower level of performance, the link must be either repaired or replaced. The test instruments must have all the necessary tests preprogrammed into their logic circuits and require no further programming by the operator. The results must be available on both print out and on disk. All test reports will be provided to the Owner for future reference. The basic link shall be tested to the specifications set in EIA/TIA 568-B.2-1, Category 6 requirements. The basic link test results shall exceed "worst case" specifications as documented in the above said standard. The tests included are:

1. End To End Connectivity
2. Cable Delay Skew
3. Cable Length Testing
4. Insertion Loss
5. Worst Pair-to-Pair NearEnd Crosstalk (NEXT) Loss
6. Power Sum Near End Crosstalk (PSNEXT) Loss
7. Worst Pair-to-Pair Equal Level Far-EndCrosstalk (ELFEXT)
8. Power Sum Equal Level Far-End Crosstalk (PSELFEXT)
9. Propagation Delay
10. Return Loss, Measured from Local End
11. Return Loss, Measured from Far End

F. Optical Fiber Media Tests - Perform verification tests and enter results on the approved test sheets for all optical fiber cables as follows:

1. Visually inspect each installed optical fiber termination connector with an illuminated microscope. Inspect for scratches, pits or chips and reterminate if any of these conditions exist.
2. Measure end-to-end loss of each terminated optical fiber at 1300 nm and 850 nm wavelengths for multimode and at 1310 nm and 1550nm wavelengths for single mode.
3. Measure each terminated fiber length and signature with an optical time domain reflectometer (OTDR) from each end of the cable. The supplier/installer shall test each reel of cable prior to installation.
4. Replace any cable if any fiber within that cable exhibits greater than 0.2 dB localized attenuation or any discontinuities.

5. Verify polarity of all dual connectors.

G. Verify shield ground for riser distribution cables.

H. Replace any defective cabling system component if any applicable parameters do not meet the EIA/TIA Category 6 EIA/TIA 568-B.2-1.

I. Final Acceptance - The communications cabling system will not be considered accepted by the Owner until the certified results of the foregoing tests have been accepted by the Owner. Beneficial use of the system by the Owner will not be considered as acceptance.

J. Test Equipment shall be as follows:

1. Tester must have the functionality to test cables complying with current and upcoming proposed standards. Test frequency range must extend to 300 MHz.

2. Measurements must include: Wiremap, Length, Insertion Loss, PSNEXT, ACR, PSACR, ELFEXT, PSELFEXT, Return Loss, Resistance.

3. Autotest must comply with TIA/ISO/IEC standards, automatic increment of circuit ID.

4. Unit must have a replaceable, rechargeable battery, Flash ROM for field updates, and storage of 1000 Autotests.

5. Unit must be capable of testing single and multi-mode fiber optic cable with a supplied adapter.

6. Test results must be uploaded into a cable management software package that supports AutoCAD diagrams.

7. Unit shall be supplied with a carrying case and all necessary adapters to test any cable configuration installed and single mode fiber optic cables.

8. Tester shall be a Microtest OMNI Scanner, or approved equal.

3.4 WORKMANSHIP

A. Communications equipment shall be installed in a neat and workmanlike manner in accordance with latest and best practices of the trade.

B. Only mechanics skilled in this type of Work shall be employed and utilized by Contractor for this Division in the execution of this Work.

3.5 REFINISHING

A. A. All surfaces of boxes, cabinets and equipment shall have suitable lacquer, enamel or plated finishes. Touch up any finishes marred during construction. Supports and other metal work not furnished with a protective coating, shall be given two coats of approved paint after completion of the work.

3.6 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of wall.

F. Extend sleeves installed in floors [2 inches (50 mm)] [Insert dimension] above finished floor level.

G. Size pipe sleeves to provide [1/4-inch (6.4-mm)] [Insert dimension] annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

a. EDGEMONT SCHOOL DISTRICT FIRE ALARM, CLOCK & PA UPGRADES

a) COMMON WORK RESULTS FOR COMMUNICATIONS

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Fireproofing of conduit sleeves shall be installed upon completion of cable installation. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [steel] [cast-iron] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.7 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 FIRESTOPPING

A. A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.9 CONTINUITY OF EXISTING SERVICES

A. A. Perform alterations and connections to existing facilities with a minimum of interruption. Where interruption is necessary, prepare a time schedule for same, coordinate with Architect, Owner and other sections, and obtain prior written clearance from Owner. Provide and place notices in affected areas, and on luminaires or equipment, etc., which will be temporarily out of use. Remove notices when interruption has been completed.

3.10 ALTERATIONS AND CONNECTIONS TO EXISTING FACILITIES

A. Make all necessary alterations to existing DIVISION 27 systems to permit connecting or extending these systems to new work and to permit existing systems to remain in use whether indicated or not. New materials used to alter existing systems shall match existing materials unless otherwise indicated. Record modifications for Owner's future use.

B. Make all necessary alterations to existing DIVISION 27 systems to permit the installation of new DIVISION 23 equipment, i.e. ductwork and piping, to permit connecting or extending these systems to new work and to permit existing systems to remain in use whether indicated or not. New materials used to alter existing systems shall match existing materials unless otherwise indicated. Record modifications for Owner's future use.

C. Where equipment, ductwork and piping is removed or disconnected under DIVISION 27, perform the work in such a manner that no damage is done to the structure or remaining portions of the systems.

D. Remove exposed conduit, hangers and supports made obsolete due to this modification.

E. Where existing concealed conduit is not to be reused, abandon same in place unless otherwise indicated or specified.

F. Unless otherwise specified, all materials and equipment removed or disconnected by Contractor which are not to be reused shall be turned over to the Owner for his future use.

G. Where excavation for new electrical work disturbs support of any existing underground services, materials, equipment and structures, provide new and suitable concrete supports as required. Review supports and supporting methods with Architect before beginning work.

3.11 COMMISSIONING

A. Commissioning will be provided as specified in Division 01 Section “Commissioning”. All contractors and subcontractors of the various sections of this specification shall cooperate and participate in the commissioning work in accordance with requirements of Division 01 Section “Commissioning”.

B. Ensure participation of major equipment manufacturers or their representatives.

C. Equipment and systems/subsystems installed under this section are expected to be in full compliance with the design intent by the commissioning phase. Notify the Commissioning Agent when any specific piece of equipment or specific system/subsystem is ready for commissioning. Be prepared to demonstrate system readiness.

D. Equipment or systems/subsystems having incomplete work or exhibiting problems related to noncompliance with the design intent shall require commissioning. The contractor for this section shall be fully responsible to make all necessary corrections to incomplete or non-complying work at their own expense and shall pay the Commissioning Agent per diem rate for recommissioning such incomplete or non-complying work.

3.12 OWNER TRAINING

A. Provide basic training to Owner's IT personnel as designated by the Owner.

B. Provide additional training seminar to include fiber optic cable installation and termination techniques.

C. Provide cabling, jacks, tools and other devices as required to provide a "hands-on" learning experience. Provide Owner with one set of tools including, but not limited to, impact tool with two (2) spare blades, shears, knife and tool pouch.

D. Training shall take place at a time to be specified by the Owner. Provide a minimum of [two] [ ] days of training time.

E. Provide facilities to videotape the training session for the Owner's future use and turn over videotape(s) to the Owner.

SECTION 27 0528
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Metallic surface pathways.
7. Nonmetallic surface pathways.
8. Tele-power poles.
9. Hooks.
10. Boxes, enclosures, and cabinets.
11. Polymer-concrete handholes and boxes for exterior underground cabling.
12. Fiberglass handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid conduit.

C. IMC: Intermediate metal conduit.

D. RTRC: Reinforced thermosetting resin conduit.

1.4 ACTION SUBMITTALS

A. Product data for the following:

1. Surface pathways

2. Wireways and fittings.

3. Tele-power poles.

4. Boxes, enclosures, and cabinets.

5. Underground handholes and boxes.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of pathway groups with common supports.

2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

3. Underground ducts, piping, and structures in location of underground enclosures and handholes.

B. Qualification Data: For professional engineer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

C. Comply with TIA-569-C.

1. GRC: Comply with ANSI C80.1 and UL 6.

2. ARC: Comply with ANSI C80.5 and UL 6A.

3. IMC: Comply with ANSI C80.6 and UL 1242.

4. PVC-Coated Steel Conduit: PVC-coated

a. Comply with NEMA RN 1.

b. Coating Thickness: 0.040 inch (1 mm), minimum.

5. EMT: Comply with ANSI C80.3 and UL 797.

6. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

7. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

8. Fittings for EMT:

a. Material: Steel

b. Type: Set screw.

c. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

d. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

9. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

2. Comply with TIA-569-C.

B. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Rigid HDPE: Comply with UL 651A.

D. Continuous HDPE: Comply with UL 651A.

E. RTRC: Comply with UL 2515A and NEMA TC 14.

1. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.

F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Description: Comply with UL 2024; flexible-type pathway, approved for plenum installation unless otherwise indicated.

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

2. Comply with TIA-569-C.

2.4 SURFACE METAL PATHWAYS

A. Galvanized steel with snap-on covers, complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with TIA-569-C.

2.5 SURFACE NONMETALLIC PATHWAYS:

A. Description: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with TIA-569-C.

2.6 HOOKS

A. General Requirements for Hooks:

1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

2. Comply with TIA-569-C.

3. Stamped steel.

4. J shape.

5. Installed every 4’-0” to center

2.7 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-C.

2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.

3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

4. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Metal Floor Boxes:

1. Material: sheet metal.

2. Type: Fully adjustable.

3. Shape: Rectangular.

4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

5. Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.

2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:

a. Loading dock.

b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

c. Mechanical rooms.

d. Gymnasiums

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.

5. Damp or Wet Locations: GRC.

6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type

7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic units in institutional and commercial kitchens and damp or wet locations.

8. Minimum Pathway Size: 3/4-inch (21-mm) trade size for copper and aluminum cables, and 1 inch (25 mm) for optical-fiber cables.

9. Pathway Fittings: Compatible with pathways and suitable for use and location.

10. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

11. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

12. EMT: Use set-screw fittings. Comply with NEMA FB 2.10.

13. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

14. Install surface pathways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.

2. NECA/BICSI 568.

3. TIA-569-C.

4. NECA 101

5. NECA 102.

6. NECA 105.

7. NECA 111.

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements in Section 270528.29 "Hangers and Supports for Communications Systems" for hangers and supports.

E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.

F. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

G. Complete pathway installation before starting conductor installation.

H. Arrange stub-ups so curved portions of bends are not visible above finished slab.

I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.

J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

M. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

O. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits of 2-inch (50-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

R. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

S. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.

2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.

3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).

2. 1-Inch (25-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).

3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

U. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.

V. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service pathway enters a building or structure.

3. Where otherwise required by NFPA 70.

W. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

3.3 Expansion-Joint Fittings:

A. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC that is located where environmental temperature change may exceed 100 deg F (55 deg C), and that has straight-run length that exceeds 100 feet (30 m).

B. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.

C. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

D. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

3.4 Cable Hooks:

A. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.

B. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.

C. Hook spacing shall allow no more than 6 inches (150 mm) of slack. The lowest point of the cables shall be no less than 6 inches (150 mm) adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.

D. Space hooks no more than 4 feet (1.5 m) o.c.

E. Provide a hook at each change in direction.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

C. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

SECTION 28 4621.11

ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Existing fire-alarm system to be modified.
2. Addressable fire-alarm system.
3. Manual fire-alarm boxes.
4. System smoke detectors.
5. Duct smoke detectors.
6. Carbon monoxide detectors.
7. Fire-alarm notification appliances.
8. Fire-alarm remote annunciators.
9. Fire-alarm addressable interface devices.
10. Digital alarm communicator transmitters (DACTs).

B. Related Requirements:
1. Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" for cables and conductors for fire-alarm systems.

1.2 DEFINITIONS

A. DACT: Digital alarm communicator transmitter.

B. FACU: Fire-alarm control unit.

C. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Annunciator panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On USB media and approved online or cloud solution.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. Installation must be by personnel certified by NICET as fire-alarm Level II technician.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXISTING FIRE-ALARM SYSTEM TO BE MODIFIED

A. Basis for Pricing (Seely Place ES): Edwards EST 3; Kidde Global Solutions

B. Basis for Pricing (Greenville ES): Edwards EST 4; Kidde Global Solutions

C. Source Limitations for Fire-Alarm System and Components: Components must be compatible with, and operate as extension of, existing system. Provide system manufacturer's certification that components provided have been tested as, and will operate as, a system.

2.2 ADDRESSABLE FIRE-ALARM SYSTEM

A. Description:

1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice-and-strobe notification for evacuation.

B. Performance Criteria:

1. Regulatory Requirements:

a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.

2. General Characteristics:
   a. Fire-alarm signal initiation must be by one or more of the following devices and systems:
      1) Manual stations.
      2) Heat detectors.
      3) Flame detectors.
      4) Smoke detectors.
      5) Duct smoke detectors.
      6) Carbon monoxide detectors.
      7) Fire-extinguishing system operation.

   b. Fire-alarm signal must initiate the following actions:
      1) Continuously operate alarm notification appliances, including voice evacuation notices.
      2) Identify alarm and specific initiating device at FACU, connected network control panels, off-premises network control panels, and remote annunciators.
      3) Transmit alarm signal to remote alarm receiving station.
      4) Unlock electric door locks in designated egress paths.
      5) Release fire and smoke doors held open by magnetic door holders.
      6) Activate voice/alarm communication system.
      7) Switch HVAC equipment controls to fire-alarm mode.
      8) Close smoke dampers in air ducts of designated air-conditioning duct systems.
      9) Activate emergency shutoffs for gas and fuel supplies, except for shutoffs serving legally required life-safety systems such as emergency generators and fire pumps.
      10) Record events in system memory.
      11) Record events by system printer.

   c. Supervisory signal initiation must be by one or more of the following devices and actions:
      1) Valve supervisory switch.
      2) High- or low-air-pressure switch of dry-pipe or preaction sprinkler system.
      3) Zones or individual devices have been disabled.
      4) FACU has lost communication with network.

   d. System trouble signal initiation must be by one or more of the following devices and actions:
      1) Open circuits, shorts, and grounds in designated circuits.
      2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
      3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
      4) Loss of primary power at FACU.
      5) Ground or single break in internal circuits of FACU.
      6) Abnormal ac voltage at FACU.
      7) Break in standby battery circuitry.
      8) Failure of battery charging.
      9) Abnormal position of switch at FACU or annunciator.
      10) Voice signal amplifier failure.

   e. System Supervisory Signal Actions:
      1) Initiate notification appliances.

2) Identify specific device initiating event at FACU, connected network control panels, off-premises network control panels, and remote annunciators.
3) Record event on system printer.
4) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
5) Transmit system status to building management system.
6) Display system status on graphic annunciator.

f. Device Guards:

1) Description: Welded wire mesh of size and shape for manual station, smoke detector, gong, or other device requiring protection.

a) Factory fabricated and furnished by device manufacturer.
b) Finish: Paint of color to match protected device.

g. Document Storage Box:

1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
3) Color: Red powder-coat epoxy finish.
4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

2.3 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
2. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
3. Able to perform at up to 90 percent relative humidity at 90 deg F.
4. Material: Manual stations made of Lexan polycarbonate.
5. Able to be used in indoor areas.

2.4 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors:
1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 268.

b. General Characteristics:

1) Detectors must be two-wire type.
2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5) Integral Visual-Indicating Light: LED type, indicating detector has operated.
6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:

a) Primary status.
b) Device type.
c) Present average value.
d) Present sensitivity selected.
e) Sensor range (normal, dirty, etc.).

8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
9) Color: White.
10) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition.
11) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
12) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
13) Multiple levels of detection sensitivity for each sensor.
14) Sensitivity levels based on time of day.

2.5 DUCT SMOKE DETECTORS

A. Description: Photoelectric-type, duct-mounted smoke detector.

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.
b. UL 268A.

2. General Characteristics:

a. Detectors must be two-wire type.
b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
d. Integral Visual-Indicating Light: LED type, indicating detector has operated.
e. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
f. Operator at FACU, having designated access level, must be able to manually access the following for each detector:

1) Primary status.
2) Device type.
3) Present average value.
4) Present sensitivity selected.
5) Sensor range (normal, dirty, etc.).

g. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
h. Each sensor must have multiple levels of detection sensitivity.
i. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
j. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 CARBON MONOXIDE DETECTORS

A. Description: Carbon monoxide detector listed for connection to fire-alarm system.

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72
b. NFPA 720.
c. UL 2075.

2. General Characteristics:

a. Mounting: Adapter plate for outlet box mounting.
b. Testable by introducing test carbon monoxide into sensing cell.
c. Detector must provide alarm contacts and trouble contacts.
d. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
e. Locate, mount, and wire in accordance with manufacturer's written instructions.
f. Provide means for addressable connection to fire-alarm system.
g. Test button simulates alarm condition.

2.7 HEAT DETECTORS

A. Combination-Type Heat Detectors:
1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 521.

b. General Characteristics:

1) Temperature sensors must test for and communicate sensitivity range of device.

c. Actuated by fixed temperature of 135 deg F or rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
d. Mounting: Twist-lock base interchangeable with smoke-detector bases.
e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
f. Detector must have functional humidity range of 10 to 90 percent relative humidity.
g. Color: White.

B. Fixed-Temperature-Type Heat Detectors:
1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 521.

b. General Characteristics:

1) Actuated by temperature that exceeds fixed temperature of 190 deg F.
2) Mounting: Twist-lock base interchangeable with smoke-detector bases.
3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
4) Detector must have functional humidity range of 10 to 90 percent.
5) Color: White.

2.8 MULTICRITERIA AND MULTISENSOR FIRE DETECTORS

A. Description: Fire-sensing detectors using multiple means of detection.

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.

2. General Characteristics:

a. Mounting: Twist-lock base interchangeable with smoke-detector bases.
b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.

c. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. Detector must send trouble alarm if it is incapable of compensating for existing conditions.
d. Test button tests sensors in detector.
e. Operator at FACU, having designated access level, must be able to manually access the following for each detector:

1) Primary status.
2) Device type.
3) Present sensitivity selected.
4) Sensor range (normal, dirty, etc.).

f. Detector must have functional humidity range within 10 to 90 percent relative humidity.
g. Color: White.
h. Comply with UL requirements.
i. Sensors (Multisensor Type): Detector must be comprised of four sensing elements including smoke sensor, carbon monoxide sensor, infrared sensor, and heat sensor.

1) Smoke sensor must be photoelectric type as described in "System Smoke Detectors" Article.
2) Carbon monoxide sensor must be as described in "Carbon Monoxide Detectors" Article.
3) Heat sensor must be as described in "Heat Detectors" Article.
4) Each sensor must be separately listed in accordance with requirements for its detector type.

2.9 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Audible Notification Appliances:
1. Description: Horns, bells, or other notification devices that cannot output voice messages.
2. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.

b. General Characteristics:

1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
3) Sounders, High Volume 24 V(dc): Less than 6 mA of alarm current.
4) Sounders, Low Volume 24 V(dc): Less than 4 mA of alarm current.
5) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
6) ISO Temporal 3 Evacuation Tone: 90 plus or minus 4 dB(A-weighted) at 24 V.
7) ISO Temporal 3 Alert Tone: 95 plus or minus 5 dB(A-weighted) at 24 V.
8) AS2220 Evacuation Tone: 93 plus or minus 4 dB(A-weighted) at 24 V.
9) AS2220 Alert Tone: 93 plus or minus 5 dB(A-weighted) at 24 V.
10) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce

sound-pressure level of 90 dB(A-weighted), measured 10 ft. from horn, using coded signal prescribed in UL 464 test protocol.

11) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Voice/Tone Notification Appliances:
1. Description: Notification appliances capable of outputting voice evacuation messages.
2. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 1480.

b. General Characteristics:

1) Speakers for Voice Notification: Locate speakers for voice notification to provide intelligibility requirements of "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
2) High-Range Units: Rated 2 to 15 W.
3) Low-Range Units: Rated 1 to 2 W.
4) Mounting: Flush.
5) Matching Transformers: Tap range matched to acoustical environment of speaker location.
6) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Fire-Alarm Visible Notification Appliances:
1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 1971.

b. General Characteristics:

1) Rated Light Output:
a) 15/30/75/110 cd, selectable in field.

2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
3) Mounting: Wall mounted unless otherwise indicated.
4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
5) Flashing must be in temporal pattern, synchronized with other units.
6) Strobe Leads: Factory connected to screw terminals.
7) Mounting Faceplate: Factory finished, white.

2.10 FIRE-ALARM REMOTE ANNUNCIATORS

A. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.

2. General Characteristics:

a. Annunciator functions must match those of FACU for alarm, supervisory, and trouble indications. Manual switching functions must match those of FACU, including acknowledging, silencing, resetting, and testing.

1) Mounting: Flush cabinet, NEMA 250, Type 1.

b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights must match those of FACU. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

A. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.

2. General Characteristics:

a. Include address-setting means on module.
b. Store internal identifying code for control panel use to identify module type.
c. Listed for controlling HVAC fan motor controllers.
d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.

e. Control Module:

1) Operate notification devices.
2) Operate solenoids for use in sprinkler service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service in accordance with requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Architect's written permission.

C. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

3.3 INSTALLATION OF EQUIPMENT

A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before other trades have completed cleanup must be replaced.
2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of building.
2. Connect new equipment to existing monitoring equipment at supervising station.
3. Expand, modify, and supplement existing control equipment as necessary to extend existing control functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
2. Mount manual fire-alarm box on background of contrasting color.
3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.

E. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

H. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.

J. Device Location-Indicating Lights: Locate in public space near device they monitor.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 26 0526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
1. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.6 PATHWAYS

A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inch above floor must be installed in EMT.

B. Exposed EMT must be painted red enamel.

3.7 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 7100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.
1. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
5. Supervisory connections at valve supervisory switches.
6. Data communication circuits for connection to building management system.

3.8 IDENTIFICATION

A. Install framed instructions in location visible from FACU.

3.9 GROUNDING

A. Ground FACU and associated circuits in accordance with Section 26 0526 "Grounding and Bonding for Electrical Systems."

B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.10 FIELD QUALITY CONTROL

A. Field tests must be witnessed by Architect.

B. Administrant for Tests and Inspections:

1. Owner will engage qualified testing agency to administer and perform tests and inspections.
2. Engage qualified testing agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections with assistance of factory-authorized service representative.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
4. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
5. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Provide video recording of training to Owner.

END OF SECTION

SECTION 31 0513
SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. General Fill.
   2. Topsoil.

1.2 REFERENCE STANDARDS

A. The following is a list of standards that may be referenced in this section:
   1. ASTM International (ASTM):
      a. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
      b. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
      c. D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
      d. D4972, Standard Test Method for pH of Soils.
      e. D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
      f. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods.
      g. D7928, Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.
      h. F1647, Standard Test Methods for Organic Matter Content of Athletic Field Rootzone Mixes.

1.3 SUBMITTALS

A. Action submittals:
   1. Submit gradations and sieve analyses, Atterberg limits, and Proctor densities to demonstrate conformance with these requirements.
   2. Submit name of imported materials source.
   3. Submit mineral analysis and nutrient content.

B. Informational submittals:
   1. Copies of agreements between Contractor and private landowner accepting spoil material.

1.4 QUALITY ASSURANCE

A. Furnish each General Fill and/or topsoil material from single source throughout Work.

PART 2 PRODUCTS

2.1 FILL AND BACKFILL MATERIALS

A. Material specifications included herein are designated as “fill” materials and apply to both fill and backfill unless otherwise specified.

B. General Fill:
   1. Excavated and reused material, graded.
   2. Free of lumps larger than 3 inches, rocks larger than 4 inches in any dimension, debris, roots wood, scrap material, vegetable matter, refuse, soft unsound particles, frozen deleterious, or other objectionable materials.
   3. Conforming to ASTM D2487 Group Symbol GW, GM, GC, SW, SM, or ML, or as otherwise approved by the Engineer.

C. Imported General Fill:
   1. Bank run gravel, conforming to NYSDOT 733-11.
   2. Percent passing by weight per sieve size:
      a. 4-inch: 100.
      b. No. 40: 0 to 70.
      c. No. 200: 0 to 15.

D. Borrow Material: When insufficient job-excavated material is available, off-site borrow material meeting the requirements of General Fill and Imported General Fill may be used.

2.2 TOPSOIL MATERIALS

A. Native topsoil:
   1. Excavated and reused material, graded.
   2. Free of roots, rocks larger than 2 inch, subsoil, debris, large weeds and foreign matter.
   3. Screening: Double screened.
   4. Conforming to ASTM D2487 Group Symbol OH or PT.
   5. Acidity range (pH) of 5.0 to 7.0.
   6. Containing minimum of 2 percent and maximum of 20 percent organic matter.

B. Imported topsoil:

1. Imported borrow, from approved borrow site.
2. Friable loam.
3. Reasonably free of roots, rocks larger than 2 inch, subsoil, debris, large weeds, and foreign matter.
4. Screening: Double screened.
5. Acidity range (pH) of 5.0 to 7.0.
6. Containing minimum of 2% and a maximum of 20% of organic material.
7. Conforming to ASTM D2487 Group Symbol OH or PT.

2.3 SOURCE QUALITY CONTROL

A. Furnish materials of each type from the same source throughout Work.

B. Testing and analysis of topsoil: Perform in accordance with ASTM D2487, ASTM F1647, and ASTM D4972.

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and/or topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. All sod cut during excavation shall be removed and stored during construction so as to preserve the grass growth, and shall be replaced in position on completion of the Work.

C. Stockpile excavated material meeting requirements for General Fill materials and topsoil materials.

D. Remove excess excavated materials not intended for reuse from the Site.

E. All spoil materials shall be lawfully disposed off-site at appropriate locations selected and obtained by Contractor.

F. No environmentally sensitive areas shall be used for spoil areas.

G. Comply with requirements for stockpile storage included in the SWPPP.

H. A copy of the signed agreement between the property owner and Contractor granting permission to deposit spoil shall be submitted to Engineer prior to placement.

I. Remove excavated materials not meeting requirements for General Fill materials and topsoil materials from the Site.

3.2 HAULING MATERIAL

A. When it is necessary to haul material over the streets or pavements, Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements.

B. In all cases where any materials are dropped from the vehicles, Contractor shall clean up the same at least daily or as often as directed and keep the crosswalks, streets and pavements clean and free from dirt, mud, stone and other hauled materials.

3.3 STOCKPILING

A. Stockpile materials on Site at locations designated and approved by Engineer and as otherwise required by Contract Documents.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. All excavation materials shall be stored in locations as to not endanger the Work, and so that easy access may be had at all times to all parts of the excavation.

D. Separate differing materials with dividers or stockpile apart to prevent mixing.

E. Stockpile topsoil 8 feet high, maximum.

F. Prevent intermixing of soil types or contamination.

G. Direct surface water away from stockpile sites to prevent erosion or deterioration of materials.

H. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed.

I. All excavated materials shall be kept clear of sidewalks, driveway entrances/exits, street crossings, and any other points that may inconvenience the public.

J. Special precautions must be taken to permit access at all times to fire hydrants, fire alarm boxes, police and fire department driveways, and other points of public convenience.

K. Where traffic is to be maintained, at least one-half of the street width must be kept open at all times.

L. Approved types of bridging across trenches shall be constructed and maintained where necessary.

M. Where conditions do not allow for storage of materials, materials excavated from the first 100 feet of any opening, or from such additional length as may be required, shall be removed from the street by Contractor as soon as excavated.

N. The material subsequently excavated shall be used to refill the trench where the utility has been built, provided it fulfills the requirements for fill materials.

O. If more material is excavated from any trench, excavation, or pit than can be refilled over the completed work or stored on the street, leaving space for traffic as herein provided, or within the limits of the right-of-way, the excess material shall be spoiled at locations selected and obtained by Contractor.

P. When the facility is complete, Contractor shall bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches, excavations, or pits.

Q. If directed by Engineer, Contractor shall refill such trenches, excavations, or pits with special backfill or other suitable materials, and excess excavated materials shall be disposed as spoil.

3.4 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade Site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition.

C. Grade Site surface to prevent free standing surface water.

++END OF SECTION++

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SECTION 31 0516
AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section includes material requirements and gradations for all unbound aggregates required by the Contract Documents.

B. Aggregate mixes including in this specification include:
   1. Granular Fill.
   2. Pipe Bedding.
   3. Structural Fill.
   4. Drainage Fill.
   5. Sand Fill.

1.2 REFERENCE STANDARDS

A. The following is a list of standards that may be referenced in this Section:
   1. American Association of State Highway Transportation Officials (AASHTO):
      a. M147, Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
      b. T180, Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.
   2. ASTM International (ASTM):
      a. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
      b. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
      c. D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3).
      d. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
      e. D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
      f. D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Materials Source: Name of imported materials Suppliers.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout Work.

PART 2 PRODUCTS

2.1 GENERAL

A. All granular materials shall be free from any organic or other deleterious materials.

B. The quality of the gravel or stone particles shall be demonstrated per ASTM C88.

C. The maximum weight loss at four (4) cycles shall be 20 percent.

2.2 MATERIALS

A. Granular Fill:
   1. Crusher run gravel, conforming to NYSDOT 733-04, Type 2 or Type 4.
   2. Percent passing by weight per sieve size:
      a. 2-inch: 100.
      b. 1/4-inch: 25 to 65.
      c. No. 40: 5 to 40.
      d. No. 200: 0 to 10.

B. Pipe Bedding:
   1. Shall consist of clean, sound, crushed stone and shall be free from coatings.
   2. Conform to NYSDOT 703-02 for coarse aggregate requirements.
   3. NYSDOT No. 1 Stone Gradation, Table 703-4:
      a. Percent passing by weight per sieve size:
         1) 1 inch: 100.
         2) 1/2 inch: 90 to 100.
         3) 1/4 inches: 0 to 15.
         4) No. 200: 0 to 1.

C. Structural Fill:
   1. Shall consist of clean, sound crushed stone and shall be free from coatings.
   2. Shall conform to NYSDOT 703-02 for coarse aggregate requirements.
   3. NYSDOT No. 2 Stone Gradation, Table 703-4:
      a. Percent passing by weight per sieve size:
         1) 1-1/2 inch: 100.

2) 1 inch: 90 to 100.
3) 1/2 inch: 0 to 15.
4) No. 200: 0 to 1.

D. Drainage Fill:
1. Shall consist of double washed crushed stone, sand, gravel, or screened gravel or recycled material approved for use per NYSDOT Section 733-19.
2. Shall conform to NYSDOT 733-20 for Underdrain Filter Material Type 1.
a. Percent passing by weight per sieve size:
1) 1 in: 100
2) 1/2 in: 30 to 100
3) 1/4 in: 0 to 30
4) No. 10: 0 to 10
5) No. 20: 0 to 5

E. Sand Fill:
1. Clean, hard, durable, uncoated particles, free from clay lumps and all deleterious substances.
2. Cushion sand, conforming to NYSDOT 703-06
3. Dry gradation, per Table 703-9:
a. Percent passing by weight per sieve size:
1) 1/4-inch: 100.
2) No. 50: 0 to 35.
3) No. 100: 0 to 10.

2.3 SOURCE QUALITY CONTROL

A. Coarse Aggregate Material, Testing and Analysis: Perform sieve analysis, plasticity index, and soundness tests in accordance with ASTM C136, ASTM D4318.

B. When tests indicate materials do not meet specified requirements, change material and retest at Contractor’s expense.

PART 3 EXECUTION

3.1 HAULING MATERIAL

A. When it is necessary to haul material over the streets or pavements, Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements.

B. In all cases where any materials are dropped from the vehicles, Contractor shall clean up the same at least daily or as often as directed and keep the crosswalks, streets and pavements clean and free from dirt, mud, stone and other hauled material.

3.2 STOCKPILING

A. Stockpile materials on Site at locations designated on the Drawings, the SWPPP, or as otherwise approved by Engineer.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition.

B. Grade Site surface to prevent free standing surface water.

++END OF SECTION++

SECTION 31 0519.13
GEOTEXTILES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This section includes performance and material requirements of geotextile underlayments as called on the Drawings, including:
   1. Filter fabric.
   2. Soil stabilization fabric.
   3. Geotextile separation fabric.

1.2 REFERENCE STANDARDS

A. The following is a list of standards which may be referenced in this section:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M288, Standard Specification for Geotextile Specification for Highway Applications.
   2. ASTM International (ASTM):
      a. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
      b. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
      c. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
      d. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
      e. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
      f. D4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
      g. D4873, Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
      h. D4884, Standard Test Method for Strength of Sewn or Bonded Seams of Geotextiles.
      i. D4886, Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method).
      j. D6524, Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats (TRMs).
      k. D6525, Standard Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products.

l. D6566, Standard Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats.
m. D6567, Standard Test Method for Measuring the Light Penetration of a Turf Reinforcement Mat (TRM).
n. D6575, Standard Test Method for Determining Stiffness of Geosynthetics Used as Turf Reinforcement Mats (TRMs).
o. D6818, Standard Test Method for Ultimate Tensile Properties of Rolled Erosion Control Products.

1.3 SUBMITTALS

A. Action submittals:
1. Product Data:
a. Manufacturer information including tensile strength, elongation, thickness, UV resistance, and other material specifications.
2. Manufacturer's Certificate: Products meet or exceed specified requirements.
3. Manufacturer Instructions: Installation requirements, including storage and handling procedures.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Inspection: Accept materials on Site in Manufacturers' original packaging and inspect for damage.

C. Comply with ASTM D4873.

D. Store materials according to manufacturer instructions.

E. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 WARRANTY

A. The Contractor shall obtain and submit to the Owner from the manufacturer a standard warranty provided for the geotextiles.

B. The warranty shall guarantee that the geotextile shall remain free from defects for a minimum of one (1) year from the date of substantial completion of the project.

C. The Engineer will review the warranty for completeness prior to the Owner accepting its provisions.

PART 2 PRODUCTS

2.1 FILTER FABRIC

A. Description: Non-woven polypropylene, needle-punched fabric.

B. Performance and design criteria:
1. Weight: 4.5 oz / sq. yd., per ASTM D5261.
2. Grab tensile: 120 lbs, per ASTM D4632.
3. Grab elongation: 50%, per ASTM D4632.
4. Trapezoidal tear strength: 50 lbs, per ASTM D4533.
5. CBR puncture Resistance: 310 lbs, per ASTM D6241.
6. Permittivity: 1.7 per second, per ASTM D4491.
7. Water flow: 135 gpm / sq ft.
8. AOS: No. 70 U.S. Sieve, per ASTM D4751.
9. UV Resistance: 70%, per ASTM D4355.

C. Manufacturer:
1. Mirafi 140N.
2. Or approved equal.

2.2 SOIL STABILIZATION FABRIC

A. Description:
1. Non-biodegradable, UV-resistant, woven geotextile fabric.
2. Material: Polypropylene.
3. Edges: Selvaged or finished to prevent separation of outer material.
4. Calendar such that yarns will retain relative positions.

B. Performance and design criteria:
1. Comply with AASHTO M288.
2. Mass per unit area: 6.0 oz./sq. yd. in accordance with ASTM D5261.
3. Tensile Strength (Grab): 315 lbs.

4. Maximum Elongation (at Break): 15 percent, in accordance with ASTM D4632.
5. Trapezoidal Tear: 120 lbs., in accordance with ASTM D4533.
6. CBR puncture Resistance: 900 lbs, per ASTM D6241.
7. Permittivity: 0.005 per second, per ASTM D4491.
8. Water flow: 4 gpm / sq ft.
9. AOS: No. 40 U.S. Sieve, per ASTM D4751.
10. UV Resistance (at 500 hours): 70%, in accordance with ASTM D4355.

C. Manufacturers:
1. U.S. Fabrics – US 315.
2. Or approved equal.

2.3 GEOTEXTILE SEPARATION FABRIC

A. Description:
1. Non-biodegradable, UV-resistant, woven geotextile fabric.
2. Meeting the requirements of NYSDOT Standard Specifications 737-01B for geotextile separation, Table 737-01B.

2.4 ACCESSORIES

A. Sewing thread: Durability equal to or greater than durability of geotextile.

2.5 SOURCE QUALITY CONTROL

A. Certificate of Compliance:
1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that underlying surface is smooth and free of ruts or protrusions that could damage geotextile material.

3.2 PREPARATION

A. Subgrade Material and Compaction Requirements: As specified in Section 31 2213, Subgrade Preparation.

3.3 INSTALLATION

A. Geotextile material:
   1. Lay and maintain smooth and free of tensile stresses, folds, wrinkles, or creases.
   2. Ensure that material is in direct contact with subgrade.
   3. Orient with long dimension of each sheet parallel to direction of slope.
   4. Minimum unseamed joints overlap: 18 inches.

B. Sand bags: Secure all geotextiles with sandbags, or an equivalent approved anchoring system.

C. Seams:
   1. Minimum seamed joints overlap: 18 inches at longitudinal and transverse joints.
   2. Seams across slope: Lap upper panel over lower panel.
   3. Side slopes:
      a. In all cases, seams on side slopes shall be parallel to the line of slope and sewn or fusion welded 5 feet from the toe-of-slope upward over the length of the slope and into the anchor trench.
      b. No horizontal seams shall be allowed on side slopes, except for patching.
   4. Sewn seams:
      a. Continuously sew seams on slopes greater than 10 percent.
      b. Stitch Type: As recommended by geotextile manufacturer.
      c. Tie off thread at the end of each seam to prevent unraveling.

D. Penetrations: As recommended by geotextile manufacturer.

E. Repairing damaged geotextiles:
   1. On slopes:
      a. A patch made from the same geotextile shall be double seamed into place; with each seam 1/4-inch to 3/4-inch apart and no closer than 1 inch from any edge.
      b. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.
   2. Flat slopes:
      a. A patch made from the same geotextile shall be spot-seamed in place with a minimum of 24 inches of overlap in all directions.
      b. Remove and replace geotextile rolls which cannot be repaired.

F. Fill and cover:
   1. Place fill to prevent tensile stress or wrinkles in geotextile.
   2. Place fill from bottom of side-slopes upward.
   3. Do not drop fill from height greater than 3 feet.

3.4 PROTECTION

A. Ballast: Provide adequate ballast to prevent uplift.

B. UV Exposure: Do not leave material uncovered for more than 14 days after installation.

C. Do not use staples or pins to hold geotextiles in place where located adjacent to other geosynthetic layers that could be damaged.

D. Do not operate equipment directly on top of geotextile.

3.5 POST-CONSTRUCTION

A. Upon completion of installation, the Contractor shall submit to the Engineer:
   1. All quality control documentation.
   2. The warranty obtained from the Manufacturer/Fabricator.

++END OF SECTION++

SECTION 31 1000
SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes the performance and material requirements to clear the Site of rubbish, debris, vegetation, pavements called for demolition, and other preparatory necessary make ready the Site for improvements as shown on the Drawings.

B. Site clearing includes, but is not limited to the removal of the following features:
   1. Surface debris.
   2. Designated paving, curbs, gutters, and sidewalks.
   3. Designated trees, shrubs, and other vegetation.
   4. Abandoned buried and overhead utilities.
   5. Scalping topsoil.

1.2 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and junk, vegetation and other organic matter, whether alive, dead or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above the ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below grade.

D. Stripping: Removal of topsoil remaining after applicable scalping is completed.

E. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.3 SUBMITTALS

A. Action submittals:
   1. Product Data: Submit data for all proposed herbicides. Indicate compliance with applicable codes for environmental protection.
   2. Submit applicator’s license, where applicable.

1.4 QUALITY ASSURANCE

A. Conform to applicable New York State Department of Environmental Conservation code for environmental requirements, disposal of debris, and use of herbicides.

B. Obtain Engineer's approval of staked clearing, grubbing, and stripping limits prior to commencement of activities.

1.5 SCHEDULING AND SEQUENCING

A. Prepare Site only after adequate erosion and sediment controls are in place.

B. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls to a maximum of 0.5 acres.

C. Schedule tree clearing, topping, and pruning to coincide with conservation windows for threatened and endangered species identified within the Project limits.

PART 2 PRODUCTS

2.1 MATERIALS

A. Herbicide: broad-spectrum systemic type, approved by authority having jurisdiction.

PART 3 EXECUTION

3.1 GENERAL

A. Comply with 16 NYCRR 753 and call UDig NY service at 811 not less than three working days before performing Work.

B. Request underground utilities to be located and marked within and surrounding construction areas.

C. Coordinate activities with utility owners.

D. Clear, grub, and strip areas actually needed for waste disposal, borrow, or Site improvements within the limits shown or specified.

E. Do not injure or deface vegetation that is not designated for removal.

F. Locate, identify, and protect utilities indicated to remain.

G. Protect bench marks, survey control points, and existing structures from damage or displacement.

H. Do not burn or bury materials on site.

I. Leave site in clean condition.

3.2 LIMITS

A. As follows, but not to extend beyond the Project limits:
   1. Excavation excluding trenches 5 feet beyond top of cut slopes.
   2. Trench excavation: 4 feet from trench centerline, regardless of actual trench width.
   3. Fill:
      a. Clearing and grubbing: 5 feet beyond the toe of permanent fill.
      b. Stripping: 2 feet beyond toe of permanent fill.
   4. Waste disposal:
      a. Clearing: 5 feet beyond the perimeter of the Project limits.
      b. Stripping: not required.
      c. Grubbing: around perimeter of the Project limits, as necessary for neat, finished appearance.
   5. Structures: 15 feet outside of new structures.
   6. Roadways: Clearing and grubbing 30 feet from roadway shoulders.
   7. Overhead utilities: Clearing and grubbing entire width of easement and rights-of-way.
   8. Underground utilities:
      a. Clearing and grubbing: 5 feet outside of excavated areas.
      b. Contractor is also responsible to clear any tree damaged, any tree that may die, or any tree that causes a potential hazard as a result of utility installation in the opinion of the Engineer.
   9. Other areas: As shown on the Drawings.

B. Remove rubbish, trash, and junk from entire area within the Project limits.

3.3 TEMPORARY REMOVAL OF INTERFERING PLANTINGS

3.4 CLEARING

A. Clear areas within limits shown or specified.

B. Fell trees so that they fall away from facilities and vegetation not designated for clearing.

C. Cut stumps not designated for grubbing flush with ground surface.

D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.5 GRUBBING

A. Grub areas within limits shown or specified.

B. Remove stumps in grubbing areas to a depth of 24-inches below existing or finished grade, whichever is greater.

3.6 SCALPING

A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Remove excess topsoil not intended for reuse, from the Site.

3.7 STRIPPING

A. Strip areas within limits to minimum depths shown or specified.

B. Do not remove subsoil with topsoil.

C. Stockpile strippings, meeting the requirements of Section 32 9200, Turf and Grasses, for topsoil, separately from other excavated material.

3.8 TREE REMOVAL OUTSIDE CLEARING LIMITS

A. Removal within Project limits:
   1. Dead, dying, leaning, or otherwise unsound trees that may strike and damage Project facilities in falling.
   2. Removal of trees outside of clearing limits must be approved by Engineer prior to work occurring.

B. Cut stumps off flush with ground, remove debris, and if disturbed, restore surrounding area to its original condition.

3.9 TREE TOPPING

A. Top trees adjacent to Project rights-of-way and easements for overhead utilities so remaining portion will not strike facilities in falling.

B. Where topping will remove more than 1/2 of the tree’s crown, remove the entire tree.

3.10 PRUNING

A. Remove branches below the following heights:

1. 13 feet 6 inches above roadways and shoulders.
2. 9 feet above sidewalks.
3. 6 feet above roofs.

B. Excavated Spoils or Objectionable Material:
1. Lawfully dispose of debris off-site.
2. Contractor is solely responsible for finding a disposal site and all costs associated with disposal.
3. Limit off-site disposal for excavated spoils or other debris to locations that are approved by Federal, State, and local authorities.

3.11 DISPOSAL

A. Clearing and grubbing debris:
1. Lawfully dispose of debris off-site.
2. Chipping:
   a. Woody debris may be chipped.
   b. Chips may be used for landscaping onsite as mulch or uniformly mixed with topsoil, provided that resulting mix will be fertile and not support combustion.
   c. Maximum dimensions of chipped material used onsite shall be 1/4-inch by 2 inches.
   d. Dispose of chips that are unsaleable or unsuitable for landscaping or other uses with unchipped debris.
3. Limit off-site disposal of clearing and grubbing debris to locations that are approved by Federal, State, and local authorities, and will not be visible from the Project.

B. Strippings:
1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil off-site.
2. Stockpile topsoil in sufficient quantity to meet Project needs.
3. Dispose of excess strippings as specified for clearing and grubbing.

++END OF SECTION++

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SECTION 31 2213
SUBGRADE PREPARATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Cutting, grading, filling, rough contouring, and compacting Site for structures, building pads, features, and roadways.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
      b. D5519, Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials.
      c. D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
      d. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods.
      e. D7928, Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Graded Soils Using the Sedimentation (Hydrometer) Analysis.

1.3 SUBMITTALS

A. Informational submittals:
   1. Submit field Proctor curves for each subgrade soil type to be prepared.

1.4 DEFINITIONS

A. Optimum moisture content: As defined in Section 31 2323, Fill.

B. Prepared ground surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade and scarification and compaction of subgrade.

C. Relative compaction: As defined in Section 31 2323, Fill.

D. Subgrade: Layer of existing soil after completion of clearing, grubbing, scalping of topsoil prior to placement of fill, roadway structures or base for floor slab.

E. Proof-rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement.

1.5 SCHEDULING AND SEQUENCING

A. Complete applicable Work specified in Section 31 1000, Site Clearing, and Section 31 2316, Site Excavation, prior to subgrade preparation.

B. Prepare subgrade when unfrozen and free of ice and snow.

1.6 QUALITY ASSURANCE

A. Notify the Engineer when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

PART 2 PRODUCTS

(Not used)

PART 3 EXECUTION

3.1 GENERAL

A. Verify survey bench mark and intended elevations for Work are as indicated.

B. Keep subgrade free of water, debris and foreign matter during compaction or proof-rolling.

C. Bring subgrade to proper grade and cross-section and uniformly compact surface.

D. Do not use sections of prepared ground as haul roads. Protect prepared subgrade from traffic.

E. Maintain prepared ground surface in finished condition until next course or lift is placed.

3.2 FIELD PROCTORS

A. Contractor shall collect representative samples of the subgrade soils to be prepared for improvement and send to an approved soils laboratory for determination maximum consolidation and optimum moisture in accordance with ASTM D1557.

B. The Contractor shall determine optimum moisture and maximum density for each soil type incorporated into the Work and when the same subsoils are sourced from different suppliers.

3.3 PREPARATION

A. Comply with 16 NYCRR 753 and call UDig NY not less than three working days before performing Work.

B. Request underground utilities to be located and marked within and surrounding construction areas.

C. Identify required lines, levels, contours, and datum.

D. Protect utilities and/or site features indicated to remain from damage.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect bench marks from excavating equipment and vehicular traffic.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, or regraded.

B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Stockpile subsoil in area designated on Site to depth not exceeding 8 feet and protect from erosion.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Tolerances: Top surface of subgrade shall be filled to +/-0.10 foot from Plan elevation.

3.6 COMPACTION

A. Under Unpaved Areas:
   1. Three passes with three-wheeled power roller weighing approximately 10 tons.

2. Compact upper 6 inches to minimum of 90 percent of the Modified Proctor.

B. Under Pavement Structure, Floor Slabs on Grades, or Granular Fill Under Structures: Compact the 6-inch to minimum 95 percent of the Modified Proctor.

3.7 MOISTURE CONDITIONING

A. Acceptable subgrade moisture range shall be between +3% and -2% of Optimum Moisture, as determined by the field Proctor.

B. Dry subgrade: Add water, then mix to make moisture content uniform throughout.

C. Wet subgrade: Aerate material by blading, disking, harrowing, or other methods to hasten the drying process.

3.8 FIELD QUALITY CONTROL

A. Proof-roll subgrade with equipment specified herein to detect soft or loose subgrade or unsuitable material.

B. Suitability determination:
1. Test soft areas identified through proof-rolling for Optimum Moisture and density, per ASTM D6938.
2. Demonstrate that material meets the definition of General Fill, per Section 31 0513, Soils for Earthwork.
3. Unsuitable subgrade:
   a. If moisture is within optimum tolerances established by the field Proctors and the material is still yielding under compactive effort, relative to adjacent subgrade, then the material will be deemed unsuitable.
   b. Notify the Engineer of unsuitable material prior to over-excavation.

C. Perform laboratory material tests according to ASTM D1557 and ASTM D422.

D. Perform in place compaction tests according to following:
1. Density and moisture tests: ASTM D6938.

E. Minimum frequency of testing: Every 500 square feet of the prepared subgrade.

3.9 CORRECTIVE ACTION

A. Soft or loose subgrade:
   1. Over-excavate the unsuitable material to no deeper than 2 feet, in accordance with Section 31 2316, Site Excavation.
   2. Line over-excavation with soil stabilization fabric, backfill with Structural Fill, and compact to maximum density.
   3. Notify Engineer if unsuitable material extends to greater than 2 feet deep.

++END OF SECTION++

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SECTION 31 2316
SITE EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes performance requirements for excavation required to construct structures and utilities as shown on the Drawings.

B. Excavation, in open cut, includes the loosening, removing, transporting, storage and disposal of all materials necessary to be removed for the construction and completion of all Work under the Contract.

C. Compliance with 16 NYCRR 753:
   1. All excavation work shall be performed in accordance with 16 NYCRR 753, Protection of Underground Facilities.
   2. All operators operating excavating equipment under this contract shall be certified under the UDig NY, Inc. Certified Excavator Program.

1.2 QUALITY ASSURANCE

A. Survey control:
   1. Provide adequate survey control to avoid unauthorized over-excavation.
   2. Identify required lines, levels, contours, and datum.

1.3 SUBMITTALS

A. Informational submittals:
   1. Excavation plan, detailing the following:
      a. Method and sequencing information.
      b. Proposed locations of stockpiled excavated materials.
      c. Proposed on-site and off-site spoil disposal sites.
      d. Number, types, and sizes of equipment proposed to perform excavations.
      e. Reclamation of on-site spoil disposal areas.

1.4 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.5 SEQUENCING AND SCHEDULING

A. Comply with 16 NYCRR 753 and call UDig NY not less than three working days before performing Work.

B. Request underground utilities to be located and marked within and surrounding construction areas.

C. Coordinate activities with utility owners.

D. Demolition: Coordinate Work as shown with excavations.

E. Clearing and Grubbing: Complete applicable Work specified in Section 31 1000, Site Clearing prior to excavating.

F. Dewatering: Conform to applicable requirements of Section 31 2319, Dewatering, prior to excavating.

G. Excavation support: Install and maintain as necessary to support sides of excavations and prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed Work.

1.6 DEFINITIONS

A. Earth: all materials such as sand, gravel, clay loam, pavements, ashes, cinders, much, roots, or pieces of timber, rippable rock, not requiring blasting, barring or wedging from its original bed, and specifically excludes all ledge and bed rock and individual boulders, concrete, or masonry larger than one-half cubic yard in volume.

B. Backfill: selected materials for the backfilling of excavations and trenches up to the original surface of the ground or to other grades as may be shown or directed.

C. Spoil: surplus excavated materials not required or not suitable for backfills or embankments.

D. Embankments: fills constructed of selected materials above the original surface of the ground.

E. Rock: ledge or bedrock requiring blasting, barring, or wedging from its original bed and individual boulders, concrete or masonry larger than one-half cubic yard in volume.

PART 2 PRODUCTS

(Not used)

PART 3 EXECUTION

3.1 GENERAL

A. Perform all excavations in accordance with 16 NYCRR 753.

B. Excavations shall be in accordance with details of applicable codes, rules, Laws and Regulations, including the Occupational Safety and Health Administration (OSHA) Title 29 Code of Federal Regulations (CFR) Part 1926, Subpart P – Excavations

C. Designate a "Competent Person" who shall be responsible for inspections of excavations on a daily basis and document and maintain daily trenching and excavation logs per OSHA 29 CFR 1926

D. Excavate to lines, grades, and dimensions shown and as necessary to accomplish the Work.
   1. Excavate to within tolerance of +/-0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum.
   2. Allow for forms, sheeting/shoring, dewatering, working space, granular base, topsoil, and similar items, wherever applicable.
   3. Trim to neat lines where concrete is to be deposited against earth.

E. Slope banks with machine to angle of repose or less until shored.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation.

G. Overexcavation:
   1. Do not overexcavate without written authorization of Engineer.
   2. Backfill unauthorized overexcavations with material as directed by Engineer at no additional cost to Owner.

H. Notify utility company to remove and relocate utilities.

I. Repair or replace items indicated to remain damaged by excavation.

J. Use of explosives is not permitted.

K. Notify Engineer of unexpected subsurface conditions.

3.2 EXCAVATION FOR STRUCTURES

A. Excavate to specified foundation elevation utilizing a flat bottom bucket.

B. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity in accordance with Section 31 2323, Fill.

C. Bearing capacity of footing subgrades shall be verified by a geotechnical engineer.

D. Soft spots or soil that is determined to have inadequate capacity shall be overexcavated and replaced as specified in Section 31 0516, Aggregates for Earthwork and placed and compacted in accordance with Section 31 2323, Fill.

E. Footing subgrades that become saturated or unstable shall be over excavated 6-inches and replaced with a 6-inch layer of Structural Fill.

F. Provide 12 inches minimum clearance between excavation faces and footing formwork.

G. Under cutting excavation faces for extended footings is not permitted.

3.3 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified.

B. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.4 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish embankments and cut slopes to conform to lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

B. Remove stones and rock that exceeds 3-inch diameter and that are loose and may roll down slope.

C. Remove exposed roots from cut slopes.

D. Round tops of cut slopes in soil to not less than 6-foot radius, provided such rounding does not extend off-site or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property or completed Work.

3.5 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Post signs indicating proposed use of material stockpiled.
   1. Signs shall be readable from all directions of approach to each stockpile.
   2. Signs shall be clearly worded and readable by equipment operators from their normal seated position.

C. Confine stockpiles to within easements, rights-of-way, and approved work areas.

D. Do not obstruct roads or streets.

E. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

F. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

G. Do not stockpile excavated material within the drip line of existing trees.

3.6 FIELD QUALITY CONTROL

A. Perform inspection of excavation and controlled fill operations to confirm stability and accordance with OSHA standards and Laws and Regulations.

B. Footing subgrades shall be verified for specified bearing capacity under all buildings by a geotechnical engineer.

3.7 PROTECTION

A. Underpin adjacent structures which may be damaged by excavation work.

B. Prevent displacement or loose soil from falling into excavation
   1. Maintain soil stability.
   2. All material which slides, falls, or caves into excavation due to any cause whatsoever shall be removed and disposed off-site.

C. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing, oversaturation, and construction traffic.

D. Protect structures, utilities and other facilities indicated to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

G. Repair or replace items indicated to remain damaged by excavation.

3.8 DISPOSAL OF SPOIL

A. Lawfully dispose of excavated materials which are unsuitable or exceed quantity needed for fill or backfill off-site.

B. Dispose of debris resulting from removal of underground facilities for demolition debris.

C. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk as specified in Section 31 1000, Site Clearing, for clearing and grubbing debris.

++END OF SECTION++

SECTION 31 2316.13
TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Excavating trenches for utilities as indicated on the Drawings or as directed by Engineer.
   2. Backfill and compaction extending up to, and including, initial backfill.
   3. Excavation for associated site structure such as manholes, inlets, and catch basins are specified in Section 31 2316, Site Excavation.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3).
   2. ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).
   3. ASTM D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. Occupational Safety and Health Administration (OSHA):
   1. 29 CFR 1926.650, Safety and Health Regulations for Construction.

1.3 SUBMITTALS

A. Action submittals:
   1. Report and certification of gradation for each type of fill.
   2. Field density reports.
   3. One optimum moisture-maximum density curve for each type of fill.
   4. Schedule replacement operations.

1.4 DEFINITIONS

A. Utility: A buried pipe, duct, conduit, or cable.

B. Pipe Zone: trench fill zone between the bottom of the pipe and the top of the pipe extending for the entire trench width.

1.5 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Concrete: Comply with Section 03 3000, Site Cast-in-Place Concrete.

B. General Fill: Comply with Section 31 0513, Soils for Earthwork.

C. Structural Fill: Comply with Section 31 0516, Aggregates for Earthwork.

D. Granular Fill: Comply with Section 31 0516, Aggregates for Earthwork.

E. Pipe Bedding: Comply with Section 31 0516, Aggregates for Earthwork.

2.2 ACCESSORIES

A. Geotextile Fabric: as specified in Section 31 0519.13, Geotextiles for Earthwork.

PART 3 EXECUTION

3.1 LINES AND GRADES

A. Lay utilities to lines and grades indicated on Drawings.

B. Engineer reserves the right to changes in lines, grades, and depths of utilities when changes are required for Project conditions.

C. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Mark all planned excavations with white paint.

B. Comply with 16 NYCRR 753 and call UDig NY at 811 not less than three (3) working days before performing Work.

C. Request underground utilities to be located and marked within and surrounding construction areas.

D. Coordinate activities with utility owners.

E. Identify required lines, levels, contours, and datum locations.

F. Protect plant life, lawns, and other features remaining as portion of final landscaping.

G. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

H. Maintain and protect above and below grade utilities indicated to remain.

I. Establish temporary traffic control when trenching is performed in public right-of-way.

J. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Excavate subsoil required for utilities.

B. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yards, measured by volume. Remove larger material as specified in Section 31 2316.26, Rock Removal.

C. All excavations within 24 inches of existing water, gas, or electric lines shall be performed according to UDig NY requirements.

D. Do not advance open trench more than 300 feet ahead of installed utility, nor leave unfilled for more than 100 feet in the rear thereof without consent of the Engineer.

E. Excavation of the trench shall be fully completed at least 20 feet in advance of the utility installation, unless specifically permitted otherwise.

F. Trenches shall not be left opened overnight. No more than 40 feet of trench shall be left opened overnight.

G. Cut trenches sufficiently wide to enable installation and allow inspection.

H. Remove water or materials that interfere with Work.

I. Excavate bottom of trenches minimum distance wider than outside diameter of pipe on each side as shown on the Drawings.

J. Where, as required by loading conditions, the width of the lower portion of the trench, measured at twelve 12 inches above the top of the pipe, exceeds

the maximum for the pipe, additional concrete cradle or concrete encasement shall be installed by Contractor.

K. Ledge rock, shale, boulders and large stones shall be removed to provide minimum bottom and side clearances, for the size of pipe being laid in each case, as follows:
   1. Minimum clearance:
      a. Below pipe: 6 inches.
      b. At sides: 6 inches.

L. Where concrete embedment or cradle is to be placed, it shall be placed in accordance with the details shown on the Drawings.

M. Excavate trenches to depth indicated on the Drawings.

N. Provide a flat bottom with uniform and continuous bearing and support for bedding material, piping and/or utilities.

O. Do not interfere with 45-degree bearing splay of foundations.

P. When Project conditions permit, slope side walls of excavation starting 24 inches above top of pipe.

Q. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.

R. Unsuitable subgrade:
   1. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered.
   2. Cut out soft areas of subgrade not capable of compaction in place as directed by Engineer and place a single layer of reinforcing geotextile fabric to cover the entire over-excavated surface area.
   3. Backfill with Bedding Material.

S. Hand trim for bell and spigot pipe joints.

T. Remove loose material.

U. Grade bottom of trench by hand to be specified line and grade with proper allowance for pipe thickness and pipe base.

V. All trenches shall be so graded that the spigot end of the pipe will be accurately centered in the adjacent pipe bell when laid, without raising the pipe off the trench bottom.

W. Re-grading of a trench bottom which is too high will be permitted.

X. Correction of a subgrade that is too low shall be done only by placing and compacting Structural Fill material in accordance with Section 31 0516, Aggregates for Earthwork over the entire width of the trench and regrading.

Y. Trench bottom shall form a continuous and uniform bearing and support for pipe between bell holes.

Z. Concrete encasement:
1. Where concrete cradle or encasement is required, the trench subgrade elevation will be determined by the required concrete section in each case.
2. Unless otherwise authorized by Engineer, concrete cradle or encasement shall extend across the full width of the trench as excavated, and the concrete therein shall be poured directly against vertical trench banks.
3. In the case of concrete cradle or encasement of pipe in a sheeted trench, the concrete may be poured directly against sheeting which is to be left in place in the trench, as specified.

3.4 TRENCH WIDTH

A. Minimum width of trenches shall be as shown on the Drawings:

B. Increase trench widths by thickness of sheeting.

C. Maximum trench width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.

3.5 PIPE BEDDING GROOVES FOR NONPERFORATED DRAIN LINES

A. Semicircular, trapezoidal, or 90-degree-V.

B. Excavated or plowed into trench bottom.

C. Forming groove by compaction is not acceptable.

3.6 TEST PITS

A. For the purpose of locating underground obstructions, Contractor shall make such excavations in advance of the Work.

3.7 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. In no case will bracing be permitted against pipes or structures in trenches or other excavations.

C. Contractor shall be solely responsible for the safety and adequacy of all sheeting and bracing.

D. Sheeting and shoring to be removed:
   1. Design sheeting and shoring to be removed at completion of excavation work.
   2. In general, all sheeting and bracing, whether of steel, timber or other material, used to support the sides of trenches or other open excavations, shall be withdrawn as the trenches or other open excavations are being refilled.
   3. That portion of the sheeting extending below the top of a pipe or sewer shall be withdrawn, unless directed, before more than six 6 inches of earth is placed above the top of the pipe and before any bracing is removed.
   4. The voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose, or otherwise as may be approved.
   5. Engineer may order Contractor to delay the removal of sheeting and bracing, if in his judgement the installed work has not attained the necessary strength to permit placing of backfill.

E. Sheeting and shoring shall be left-in-place after excavation.

F. Repair damage caused by failure of sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

G. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.8 PIPE BEDDING

A. Install to full width of trench, as detailed on the Drawings.

B. Compact to at least 95 percent of its maximum density as determined by ASTM D1557

C. Ensure that no unfilled or uncompacted areas occur beneath pipe.

D. Bell (Joint) holes: At each joint, dig bell holes of ample dimensions in bottom of trench, and at sides where necessary, to permit joint to be made properly and to permit easy visual inspection of entire joint.

E. Protect all utilities from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in suitable pipe embedment material.

F. Concrete cradles and pipe encasement:
   1. Install concrete cradles and encasement where shown on the Drawings or ordered by Engineer.
   2. Brace pipe in all directions to prevent flotation prior to concrete placement.

3.9 BACKFILLING

A. General:
   1. Backfill trenches to contours and elevations with unfrozen fill materials.
   2. Install metallic tape
   3. Systematically backfill to allow maximum time for natural settlement.
   4. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
   5. Maintain optimum moisture content of fill materials to attain required compaction density.
   6. When for any reason the work is left unfinished, all trenches and excavations shall be filled and all roadways and sidewalks left unobstructed with their surfaces in a safe and satisfactory condition.
   7. Protect and cover open trench to prevent danger to the public with H20 load rated road plates.

B. Haunching:
   1. Place in 6-inch lifts compacted to at least 95 percent of its maximum density, as determined by ASTM D1557
   2. Place such that even distribution is maintained on each side of the pipe at all times.

C. Initial Backfill:
   1. Place in 6-inch lifts compacted to at least 95 percent of its maximum density, as determined by ASTM D1557 unless otherwise specified.
   2. Place such that even distribution is maintained on each side of the pipe at all times.

D. Final Backfill shall be in accordance with Section 31 2323, Fill.

3.10 DRAINAGE

A. All material deposited in roadway ditches or other water courses crossed by the line of trench or near a structure shall be removed immediately after backfilling is completed and the section grades and contours of such ditches or water course restored to their original condition, in order that surface drainage will be obstructed no longer than necessary.

B. Backfilling of trenches for pipes installed beneath or across roadways, driveways, walks and other traffic ways adjacent to drainage ditches and water courses shall not be done prior to the completion of backfilling to the original ground surface of the trench on the upstream side of such traffic-way in order to prevent the impounding of water at any point after the pipe has been laid, and all necessary bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained.

C. All backfilling shall be done in such a manner that water will not accumulate in unfilled or partially filled trenches.

D. When trenches are constructed in or across roadway ditches or other water courses, the backfill shall be protected from surface erosion by adequate and environmentally sound means.

3.11 RESTORATION OF SURFACES

A. The various types of street surface, gutters and culverts, disturbed, damaged or destroyed during the performance of the Work under Contractor, shall be restored and maintained as specified herein and as shown and directed.

B. Restoration of property:
   1. Contractor shall restore all pavement, driveways, sidewalks, gutters, culverts, trees, shrubs, lawns, landscaped areas and any other public or private property damaged as a result of Work under this Contract.
   2. The quality of materials and workmanship used in the restoration shall produce a condition equal to or better than the condition before the work began.

C. Time of replacement:
   1. In general, permanent restoration of street surfaces will not be permitted until one month’s time has elapsed after trenches have been completely backfilled as specified.
   2. A greater length of time, but not more than nine 9 months, may be allowed to elapse before permanent restoration of street surfaces is undertaken, if, in the opinion of Engineer such additional time is required for complete shrinkage and settlement of the backfill.

3. If Contractor is permitted to replace pavement at any time by Engineer, it shall not relieve Contractor of responsibility to make repairs to damage caused by settlement for a period of one year, or as elsewhere specified.

D. Schedule of operation: Develop a schedule of replacement operations and submit for approval.

E. Temporary resurfacing and repaving:
1. Immediately upon completion of refilling of the trench or excavation, Contractor shall place a temporary pavement over all disturbed areas of the streets, driveways, alleys and other traveled places where the original surface has been disturbed by his operations.
2. The temporary re-pavement shall be of a character satisfactory in all respects and safe for public travel.
3. The temporary resurfacing shall consist of a minimum of six inches of well-graded broken stone with such additional depth as is necessary to withstand the traffic to which it is subjected.
4. Where concrete pavements are removed, the broken stone shall be surfaced with “cold patch”.
5. The surface of the temporary repaving shall conform to the street grades.
6. Mounding up of the material over the trench and covering the same with loose broken stone will not be considered as compliance with the above requirements.

F. Dust control:
1. Treat all surfaces, not covered with cold patch, as approved by Engineer.
2. Use of calcium chloride and/or petroleum products for dust control is prohibited.

G. Maintenance:
1. Maintain temporary re-pavement in a safe and satisfactory condition until permanent repaving is complete.
2. Contractor shall immediately remove and restore to a satisfactory condition any and all such resurfacing and re-pavements as shall become unsatisfactory and not in accordance with the terms and intent of the Contract Documents.

H. Preparation for Permanent Replacement:
1. After due notice and within the time specified, the temporary broken stone or gravel pavement shall be prepared as the base to receive the permanent pavement in accordance with Section 32 1123, Aggregate Base Course for Exterior Improvements.

2. It shall be brought to the required grade and cross section and thoroughly compacted before placing the permanent pavement.
3. Service boxes, manhole frames and covers, and similar structures, within the area of pavement to be replaced and not conforming to the new work, shall be set to established grade by Contractor.

3.12 FIELD QUALITY CONTROL

A. Perform in place compaction tests in accordance with the following:
   1. Density Tests: ASTM D1557.
   2. Moisture Tests: ASTM D3017.

B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

C. Frequency of tests: Each lift every 100 linear feet of trench.

D. The following reports in quadruplicate shall be submitted directly to the Engineer:
   1. Report and Certification of Gradation.
   2. Field Density Reports.
   3. One optimum moisture-maximum density curve for each type of fill.

3.13 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.14 TRENCH BACKFILL SCHEDULE

A. Pipe and Buried Utility Foundations: Structural Fill

B. Bedding:
   1. Pipe Bedding Material: All piping unless otherwise specified extending below the outside diameter of the pipe barrel as shown on the Drawings.
   2. Sand: Copper, PVC, and HDPE, extending below the outside diameter of the pipe barrel as shown on the Drawings.

C. Haunching:
   1. Pipe Bedding Material: All piping unless otherwise specified.
   2. Sand: Copper, PVC, and HDPE.

D. Initial Backfill:
   1. Pipe Bedding Material: All piping unless otherwise specified.
   2. Sand: Copper, PVC, and HDPE.

E. Final Backfill:
   1. General Fill or borrow material.

++END OF SECTION++

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SECTION 31 2316.26
ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes performance and material requirements to remove rock from within the limits of the Work.

1.2 REFERENCE STANDARDS

A. The following is a list of standards and rules which may be referenced in this section:
   1. New York Codes, Rules, and Regulations (NYCRR):
      a. Part 23, Protection in Construction, Demolition and Excavation Operations.
      b. Part 39, Possession, Handling, Storage, and Transportation of Explosives.
   2. New York State Department of Transportation, Geotechnical Engineering Manual (GEM):
      a. 22, Procedures for Blasting.

1.3 DEFINITIONS

A. Site Rock: Solid mineral monolithic material with volume in excess of 1/2 cu. yd that cannot be ripped or removed with a 150-hp bucket excavator without drilling or hydraulic hammering.

B. Rock Excavation: The loosening, removing, transporting, storing and disposal of all materials requiring blasting, barring, or wedging for removal from their original beds.

C. Trench Rock: Solid mineral material with volume in excess of 1/6 cu yd or solid material that cannot be ripped and removed with 150-hp bucket excavator without drilling or hydraulic hammering.

1.4 QUALITY ASSURANCE

A. Blasters shall possess a valid New York State Department of Labor-issued Blaster Certificate of Competence.

B. Blasters shall possess an Explosives License to purchase, own, possess, or transport explosives.

1.5 SCHEDULING AND SEQUENCING

A. Schedule Work to avoid disruption to occupied buildings nearby.

B. Conduct rock removal operations to occur on weekdays between hours of 8:00 a.m. and 5:00 p.m. only.

PART 2 PRODUCTS

(Not used)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify Site conditions and note subsurface irregularities affecting Work of this Section.

B. Notify the Engineer prior to commencing rock removal.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Rock excavations shall be made to the widths and depths shown on the Plans or as directed by the Engineer.

B. For concrete structures, excavated rock only to the bottom of the structure unless otherwise shown or noted on Drawings.

C. Excavate and remove rock by mechanical method.

D. Drill holes and use expansive tools, wedges, and/or mechanical disintegration compound to fracture rock.

E. Cut away rock at bottom of excavation to form level bearing.

F. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

G. Lawfully dispose of surplus rock offsite.

H. All excavated rock which cannot be handled and compacted as earth shall not be mixed with other backfill or embankment materials and shall be removed from site except as specified herein or as directed.

I. Correct unauthorized rock removal according to backfilling and compacting requirements of Section 31 2323, Fill as directed by the Engineer.

3.4 BLASTING

A. All blasting shall be planned and executed by a qualified blasting engineer, as specified herein, subcontracted to the General Contractor.

B. All blasts in open cut shall be properly covered and protected with heavy timber chained together or approved blasting mats.

C. Charges shall be of such size that the excavation will not be unduly large and shall be so arranged and timed that adjacent rock upon or against which structures to be built will not be shattered.

D. Blasting shall be conducted in accordance with all applicable rules and regulations.

E. Where blasting occurs in highways under NYSDOT jurisdiction or jurisdictions adhering to NYSDOT Standard Specifications, comply with Standard Specification Section 107-05 and Section 203-3.05.

F. Protect all existing pipelines, conduits, and structures exposed during excavation before proceeding with the blasting operation.

G. Repair or rebuild all pipelines, conduits, and structures damaged by the blasting operations.

H. Whenever the Engineer determines that further blasting may damage adjacent rock, pipelines or structures, blasting shall be discontinued and the rock removed by drilling, barring, wedging, or other methods.

I. Sound danger signals prior to firing each blast.

J. Radio frequency (RF) interference:
   1. Blasting shall not be conducted within three hundred (300) feet of any radio transmitter or radio frequency emission equipment such as high frequency welders.
   2. Blasting caps shall be kept tightly closed in metal cans when in vicinity of such equipment.

K. Explosives:
   1. At no time shall an excessive amount of explosives be kept at the site.
   2. Explosives shall be stored, handled, and used in conformity with all applicable laws and regulations.

3. Keep accurate daily records showing quantity of explosives on-hand, both at the site and all storage magazine, quantities received and issued, and the purpose for which issued.
4. Submit copies of all records to the Engineer.
5. Contractor shall be responsible for all damage and injury to persons, property or structures as a result of blasting operations.

++END OF SECTION++

SECTION 31 2319
DEWATERING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Dewatering system.
   2. Surface water control system.
   3. Monitoring wells.
   4. System operation and maintenance.
   5. Water disposal.

1.2 REFERENCE STANDARDS

A. The following is a list of standard which may be referenced in this Section:
   1. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.

1.3 SUBMITTALS

A. Informational submittals:
   1. Submit proposed dewatering plan, including the following:
      a. Product information for sediment control.
      b. Pump product information, cut sheets, and performance curves.

1.4 DEFINITIONS

A. Dewatering includes the following:
   1. Lowering of ground water table and intercepting horizontal water seepage to prevent ground water from entering excavations and trenches.
   2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations and trenches.
   3. Disposing of removed water.
   4. Surface Water Control: Removal of surface water within open excavations or cofferdams.

1.5 SYSTEM DESCRIPTION

A. Provide dewatering and surface water control systems to permit Work to be completed on dry and stable subgrade.

B. Furnish standby equipment stored at Project site and ready for immediate use upon failure of dewatering equipment.

1.6 PERFORMANCE REQUIREMENTS

A. Design dewatering systems to:
1. Lower water table within areas of excavation to minimum of 2 feet below bottom of excavation to permit Work to be completed on dry and stable subgrade.
2. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.
3. Prevent damage to adjacent properties, buildings, structures, utilities, and facilities from construction operations.
4. Prevent loss of fines, quick condition, or softening of foundation subgrade.
5. Maintain stability of sides and bottoms of excavations and trenches; face, walls, and bottoms of tunnels; and side and bottoms of shafts.
6. Comply with water quality criteria specified in the discharge permit for the receiving stream.

B. Design surface water control systems to:
1. Collect and remove surface water and seepage entering excavation.
2. Comply with water quality criteria specified in the discharge permit for the receiving stream.

1.7 QUALITY ASSURANCE

A. Comply with authorities having jurisdiction for the following:
1. Drilling and abandoning of wells used for dewatering systems.
2. Water discharge and disposal from pumping operations.
3. Assume sole responsibility for dewatering and surface water control systems and for loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations.

1.8 SEQUENCING

A. Sequence work to obtain required permits before start of dewatering operations.

B. Sequence Work to install and test monitoring systems minimum 3 days before testing and operating dewatering systems.

C. Sequence work to install and test dewatering and surface water control systems minimum 3 days before starting excavation, trenching, tunneling, and/or shaft drilling.

PART 2 PRODUCTS

2.1 DEWATERING EQUIPMENT

(Not used)

PART 3 EXECUTION

3.1 EXAMINATION

A. Comply with 16 NYCRR 753 and call UDig NY Utility Line Information service at 811 not less than three (3) working days before performing Work.

B. Request underground utilities to be located and marked within and surrounding construction areas.

3.2 PREPARATION

A. Protect existing adjacent buildings, structures, and improvements from damage caused by dewatering operations.

3.3 DEWATERING SYSTEM

A. Locate system components to allow continuous dewatering operations without interfering with installation of permanent Work and existing public right-of-way, sidewalks and adjacent buildings, structures, and improvements.

B. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least twenty-four (24) hours after placement, and no stream of water shall be allowed to flow over such work until such time as the Engineer may permit.

C. Unless otherwise specified, all excavations which extend down to below the ground water elevation at the sites of structures shall be dewatered by lowering and maintaining the ground water beneath such excavations at an elevation not less than that specified herein at all times when work thereon is in progress, during subgrade preparation and the placing of structures or pipe thereon.

D. Install wellpoints to stabilize the subgrade when an upward pressure or flow of water in combination with a fine-grained subsurface material may cause a quick condition.

E. Wellpoint headers, points and other pertinent equipment shall not be placed within the limits of the excavation in such a manner or location as to interfere

with the laying of pipe or trenching operations or with the excavation for and construction of other structures.

F. In areas where ground water enters the excavation but does not cause a quick condition, the ground water may be removed by any practical method which does not damage the subgrade, cause the same to become unstable or interferes with the construction operations.

3.4 SURFACE WATER CONTROL SYSTEM

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area.

B. Divert surface water and seepage water within excavation areas into sumps and pump water into drainage channels, storm drains, and/or settling basins in accordance with requirements of agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

3.5 SYSTEM OPERATION AND MAINTENANCE

A. The Contractor shall at all times during construction provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of pipe, masonry, concrete, structures or other work.

B. Where wellpoints are used, the groundwater table shall be continuously (day and night) maintained to an elevation of not less than twenty-four (24) inches below the excavation and when subgrade is reached the ground water shall be maintained not less than twenty-four (24) inches below the subgrade.

C. The ground water control requirements specified for well-pointing operations apply to other dewatering methods.

D. Operate dewatering system continuously until backfill is minimum 1 foot above normal ground water table elevation and structures will not float.

E. Suitable stand-by pumping equipment shall be provided to insure the maintenance of the specified lowering of the water table.

F. Provide supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.

G. Conduct daily observation of dewatering system and monitoring system.

H. Make required repairs and perform scheduled maintenance.

I. Fill fuel tanks before tanks reach 25 percent capacity.

J. Modify dewatering and surface water control systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

K. Correct unanticipated pressure conditions affecting dewatering system performance.

L. Do not discontinue dewatering operations without Engineer's approval.

M. Repair all damage caused by improper management of water.

3.6 WATER DISPOSAL

A. Water pumped or drained from excavations, or any sewers, drains, or water courses encountered in the work, shall be disposed of in a suitable and environmental manner without injury to adjacent property, the work under construction, or to pavements, roads and drives.

B. No water shall be discharged into sanitary sewers.

C. Sanitary sewage shall be pumped to sanitary sewers or shall be disposed of by an approved method.

3.7 SYSTEM REMOVAL

A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

3.8 FIELD QUALITY CONTROL

A. After dewatering system is installed, perform pumping test to determine when selected pumping rate lowers water level in well below pump intake.

B. Adjust pump speed, discharge volume, or both to ensure proper operation of each pump.

++END OF SECTION++

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SECTION 31 23

23 FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for tank excavations.

1.02 RELATED REQUIREMENTS

A. Section 01 57 13 - Temporary Erosion and Sedimentation Control: Slope protection and erosion control.

B. Section 32 1313 - Concrete Paving - Base for sidewalk

C. Section 02 6500 - Underground Storage Tank Removal - Backfill

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: 5 inches below finish grade elevations indicated on drawings, unless otherwise indicated.

1.04 REFERENCE STANDARDS

A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill - Fill Type Select Granular: Conforming to State of NYSDOT Highway Department standard.

B. Structural Fill - Fill Type Select Structural Fill : Conforming to State of NYSDOT Highway Department standard.

C. Granular Fill - Pea Gravel : Natural stone; washed, free of clay, shale, organic matter.
   1. Grade in accordance with ASTM D2487 Group Symbol GM.

D. Sand: Conforming to State of NYSDOT Highway Department standard.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

3.02 PREPARATION

A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Structural fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. The following are basic requirements for backfilling:

a. Both primary and secondary backfill material is to be clean, free-flowing, and free of dirt, sand, large rocks, roots, organic materials, debris, ice and snow.

b. No backfill material shall be frozen or contain lumps of frozen material any time during compaction or placement.

c. Use coarse aggregate (rounded stones or crushed stones) as primary backfill material. Size requirements: Rounded: 3/4”-1/8”, Crushed: 1/2”-1/8”. Primary backfill material should be a mix of well-graded stones, generally conforming to the 6, 67, 7 and 8 sizes of ASTM’s C33. 4. No more than 5% of this material can be small enough to pass through the #8 sieve.

d. Do not use materials like soft limestone, sandstone, seashells or shale.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: (where applicable) place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Slope grade away from buildings for a minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:
1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.
2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Structural Fill at sidewalks:
1. Maximum depth per lift: 8 inches, compacted.
2. Compact to minimum 95 percent of maximum dry density.

3.05 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Proof roll compacted fill at surfaces that will be under paving.

END OF SECTION

SECTION 31 2323
FILL (SITE)

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Backfilling Site structures to subgrade elevations.
   2. Fill under paving.
   3. Fill for over-excavation.

B. Related Work specified elsewhere:
   1. Section 31 0513, Soils for Earthwork.
   2. Section 31 0516, Aggregates for Earthwork.
   3. Section 31 0519.13, Geotextiles for Earthwork.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft).
   2. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Material source: Submit name of imported fill materials suppliers.

1.4 DEFINITIONS

A. Optimum moisture: the moisture content in a cohesive soil that results in a maximum compacted density, in accordance with ASTM D1557.

B. Relative compaction:
   1. The reduction in volume of aggregates and aggregate mixes after vibratory compaction, expressed as a percent volume reduction from a loose, dumped state to a compacted state.
   2. Relative compaction is only measured on cohesionless soils.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General Fill: As specified in Section 31 0513, Soils for Earthwork.

B. Structural Fill: As specified in Section 31 0516, Aggregates for Earthwork.

C. Granular Fill: As specified in Section 31 0516, Aggregates for Earthwork.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, non-woven as specified in Section 31 0519.13, Geotextiles for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that sub-drainage, dampproofing, or waterproofing installation has been inspected.

B. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

C. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Unsuitable Materials:
   1. Cut out soft areas of subgrade not capable of compaction in place.
   2. Backfill with Structural Fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 6 inch.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement.

C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Place material in continuous layers as follows if not specified elsewhere:
   1. General Fill: Maximum 8 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 6 inches compacted depth.

E. Compaction:
   1. Underneath Structures, Paving, Sidewalks, Final Backfill for Trenches, and all Other Areas Not Specifically Identified: Compact to at least 95 percent of its maximum density, as determined by ASTM D1557.
   2. Underneath Grassed Areas: Compact to at least 90 percent of its maximum density, as determined by ASTM D1557.

F. Employ placement method that does not disturb or damage other Work.

G. Maintain optimum moisture content of backfill materials to attain required compaction density.

H. Remove surplus backfill materials from Site at no additional cost to Owner.

I. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Top surface of backfilling under paved areas: Plus or minus 1 inch from required elevations.

B. Top Surface of general backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Perform laboratory material tests according to ASTM D1557.

B. Perform in place compaction tests according to following:
   1. Density tests: in accordance with ASTM D6938.
   2. Moisture Tests: in accordance with ASTM D6938.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Tests: once per lift.

E. Proof roll compacted fill surfaces under paving.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 FILL SCHEDULE

A. As per drawings and details.

++END OF SECTION++

SECTION 32 3121
ALUMINUM LOUVER FENCE AND GATES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Fence framework and accessories.

B. Fixed louver modular fencing panels .

C. Manual gates with related hardware.

D. Accessories.

1.3 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete anchorage for posts.

B. Section 31 2316 - Excavation.

1.4 REFERENCES

A. ASTM B117 - Operating Salt Spray (Fog) Apparatus.

B. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM D822 - Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

E. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

F. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.5 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on components, accessories,

C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

D. Samples: Submit two samples of slat infill, 8 inch by 12 inch in size illustrating construction and colored finish.

E. Manufacturer's Installation Instructions: Indicate installation requirements

F. Copy of warranty specified in Paragraph 1.4 for review by Architect.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five (5) years of documented experience.

B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide ten (10) year manufacturer warranty for factory finish against cracking, peeling, and blistering under normal use..

1.8 DELIVERY, STORAGE AND HANDELING

A. Deliver products in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360.

1. Substitutions: See Section 001 2500 Substitution Prosedures

2.2 MATERIALS

A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.

B. Sheet aluminum: ASTM B209, Alloy 6063, Temper T-6.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing additives

2.3 FENCE SYSTEM

A. Saturn: Extruded tubular aluminum blades.

1. Type: Ornamental fencing system consisting of vertical, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts.

B. Fence panel:

1. Extruded aluminum sections, powder coat finish, 1/2" × 4" (12.7 × 102 mm) extruded aluminum tubes spaced 1" - 4" (25.4 - 102 mm) apart; fencing to be configured vertically.

2. Height: 10'-0".

2.4 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, double padlock hasp; keepers to hold gate in fully open position.

B. Hinges: Finished to match fence components as recommended by the manufacturer.

1. Closing: Manual.

C. Latches: Finished to match fence components as recommended by the manufacturer.

D. Gates shall be furnished and installed where indicated on the plans or directed by the Owner's Representative. All necessary fittings and gate holders to lock gates in both open and closed positions shall be furnished. The locking device shall be as recommended by the manufacture. Gates shall be constructed of the same materials and finishes as the fence. All gates shall be braced as recommended by the manufacturer. All gates shall be so arranged that they can be locked when closed and locked back to the fence when open.

E. Owner will furnish padlocks.

2.5 ACCESSORIES

A. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

B. Fasteners: Stainless steel.

2.6 FINISHES

A. Fences and gates shall be manufacturer's standard powder coat colors.

B. Color(s): To be selected by Fuller and D'Angelo, P.C. from manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

B. Verify that site conditions are acceptable for installation. Do not proceed with installation until unacceptable conditions are corrected

C. Field verify required dimensions. Post spacing as indicated on drawings.

3.2 PREPARATION

A. Removal: Obstructions or debris.

B. Coordinate fence and gate installation with provision of gate operator,

3.3 INSTALLATION

A. Cast concrete footings as detailed on approved shop drawings. Provide setting holes or core drill existing concrete footings for fence post embedment.

1. Temporarily support before permanently setting it into concrete. After the fence is plumb and level, concrete grouting can be poured into post holes

2. Temporarily brace fence posts, then secure fence panels to posts.

B. Do not install fence panels that are bent, bowed or otherwise damaged.

C. Space fasteners and secure to posts. Install accessories,

D. Brace each gate and corner post to adjacent line post with horizontal center brace rail.

E. Do not attach the hinged side of gate to building wall; provide gate posts.

F. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

G. Install gate locking device.

H. Perform three random field inspections confirming proper installation.

I. Attach aluminum caps to posts and touch up any damaged finish

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

C. Do not infringe on adjacent property lines.

3.5 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations and underground utilities

C. Post Settings: Randomly inspect three locations against design for:

1. Hole depth.

2. Hole spacing.

D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.

E. Gates: Inspect for level, plumb, and alignment.

F. Workmanship: Verify neat installation free of defects.

3.6 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material.

B. Clean fence with mild household detergent and clean water rinse well.

C. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Demonstrate proper operation of equipment to YPS Office of Facilities Management.

SECTION 31 2323
FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Backfilling Site structures to subgrade elevations.
   2. Fill under paving.
   3. Fill for over-excavation.

B. Related Work specified elsewhere:
   1. Section 31 0513, Soils for Earthwork.
   2. Section 31 0516, Aggregates for Earthwork.
   3. Section 31 0519.13, Geotextiles for Earthwork.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft).
   2. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Material source: Submit name of imported fill materials suppliers.

1.4 DEFINITIONS

A. Optimum moisture: the moisture content in a cohesive soil that results in a maximum compacted density, in accordance with ASTM D1557.

B. Relative compaction:
   1. The reduction in volume of aggregates and aggregate mixes after vibratory compaction, expressed as a percent volume reduction from a loose, dumped state to a compacted state.
   2. Relative compaction is only measured on cohesionless soils.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General Fill: As specified in Section 31 0513, Soils for Earthwork.

B. Structural Fill: As specified in Section 31 0516, Aggregates for Earthwork.

C. Granular Fill: As specified in Section 31 0516, Aggregates for Earthwork.

2.2 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, non-woven as specified in Section 31 0519.13, Geotextiles for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that sub-drainage, dampproofing, or waterproofing installation has been inspected.

B. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

C. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill materials.

B. Unsuitable Materials:
   1. Cut out soft areas of subgrade not capable of compaction in place.
   2. Backfill with Structural Fill and compact to density equal to or greater than requirements for subsequent fill material.

C. Scarify subgrade surface to depth of 6 inch.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Backfill areas to contours and elevations with unfrozen materials.

B. Systematically backfill to allow maximum time for natural settlement.

C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Place material in continuous layers as follows if not specified elsewhere:
   1. General Fill: Maximum 8 inches compacted depth.
   2. Structural Fill: Maximum 6 inches compacted depth.
   3. Granular Fill: Maximum 6 inches compacted depth.

E. Compaction:
   1. Underneath Structures, Paving, Sidewalks, Final Backfill for Trenches, and all Other Areas Not Specifically Identified: Compact to at least 95 percent of its maximum density, as determined by ASTM D1557.
   2. Underneath Grassed Areas: Compact to at least 90 percent of its maximum density, as determined by ASTM D1557.

F. Employ placement method that does not disturb or damage other Work.

G. Maintain optimum moisture content of backfill materials to attain required compaction density.

H. Remove surplus backfill materials from Site at no additional cost to Owner.

I. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Top surface of backfilling under paved areas: Plus or minus 1 inch from required elevations.

B. Top Surface of general backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Perform laboratory material tests according to ASTM D1557.

B. Perform in place compaction tests according to following:
   1. Density tests: in accordance with ASTM D6938.
   2. Moisture Tests: in accordance with ASTM D6938.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Tests: once per lift.

E. Proof roll compacted fill surfaces under paving.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 FILL SCHEDULE

A. As per drawings and details.

++END OF SECTION++

SECTION 31 2323.33
FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

A. Scope: This Section includes material and performance requirements for all controlled low strength materials, where called on the Drawings.

B. Definitions, as used herein:
1. Controlled Low Strength Material (CLSM): A self-leveling and self-compacting, cementious material with an unconfined compressive strength of at least 40 psi.
2. Flowability: Material property, which relates to the rheology of the material.
3. Excavatability: Material property which relates to the ease to which the material may be mechanically removed by ripping with a backhoe bucket.
4. Permeability: Material property which relates to the ease with which gases and liquids flow through the material.
5. Strength: Material property that relates to the ability of hardened material to support gravity loads or stresses at a specified age.
6. Thermal conductivity: Material property quantifying the rate of heat transfer through a solid material.
7. Thermal insulating value: The reciprocal of thermal conductivity.
8. CLSM Air-Generating Admixture: A chemical admixture specially formulated to entrain air into CLSM.
9. Hardening Time: Period of time for CLSM mixtures to reach a state in which it will support a specified load.
10. Subsidence: The reduction in initial in-place volume caused by the displacement of water and release of entrapped air as a result of consolidation.
11. Corrosive Resistance: Material property relating the ability to inhibit the corrosion of embedded materials.
12. pH: A numeric scale measuring acidity or basicity in an aqueous solution.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):
1. C403, Standard Test Method for Time of Settling of Concrete Mixtures by Penetration Resistance.
2. C869, Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.

3. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
4. D1883, Standard Test Method for the California Bearing Ratio.
5. D4832, Standard Test Method for the Preparation and Testing of Controlled Low Strength Material Test Cylinders.
6. D5084, Standard Test Methods for the Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
7. D5971, Standard Practice for Sampling Freshly Mixed Controlled Low-Strength Material.
8. D6103, Standard Test Method for Flow Consistency of Controlled Low Strength Material.
9. D6023, Standard Test Method for Density (Unit Weight), Yield, Cement Content and Air Content (Gravimetric) of Controlled Low-Strength Material.
10. D6024, Standard Test Method for Ball Drop on Controlled Low Strength Material to Determine Suitability for Load Application

B. American Association of State Transportation Officials (AASHTO):
1. M6, Fine Aggregates for Portland Cement Concrete.
2. M80, Coarse Aggregate for Portland Cement Concrete.
3. M85, Portland Cement.
4. M154, Air Entraining Admixture Concrete.
5. M157, Ready-Mix Concrete.
6. M194, Chemical Admixtures for Concrete.
7. M195, Lightweight Aggregate for Structural Concrete.
8. M240, Blended Hydraulic Concrete.
9. M295, Fly Ash and Raw or Calcined Natural Pozzolan for Use as Mineral Admixtures in Portland cement Concrete.
10. M302, Ground Granulated Blast Furnace Slag for Use in Concrete and Mortars.

1.3 SUBMITTALS

A. Action submittal:
1. Submit material source(s).
2. Mix Design:
   a. Submit mix design for each specified strength and certified test results.
   b. Submit separate mix designs when admixtures are required for the following:
      1) Work during hot and cold weather.
      2) Air entrained work.
   c. Identify design mix ingredients, proportions, properties, admixtures, and tests.

d. Submit test results to certify mix design properties meet or exceed specified requirements.

3. Method of installation:
   a. Submit the CLSM placement sequence.
   b. Submit the planned procedure to account for subsidence during the settling and curing process.
4. Quality Assurance: Submit test results for material placed, demonstrating conformance to these specifications.

B. Informational submittals: Submit duplicate delivery tickets indicating quantities materials delivered.

PART 2 PRODUCTS

2.1 GENERAL

A. Controlled low-strength material (CLSM) shall be produced with materials conforming to the standards specified herein.

B. Materials not conforming to standards specified herein shall only be incorporated after review and approval by the Engineer.

2.2 MATERIALS

A. General:
1. All materials shall meet requirements for the respective items in Section 500 of the NYSDOT Standard Specifications with the following exceptions:
   a. Hydraulic cement shall conform to AASHTO M85, AASHTO M240 or ASTM C150, Type I or Type II.
   b. Fly ash:
      1) Shall meet requirements of ASTM C618, Class C.
      2) Source shall be approved by the Engineer.
   c. Fine aggregate:
      1) Conform to AASHTO M6.
      2) Gradation:
         a) 3/4-inch sieve: 100 percent passing
         b) No. 200 sieve: 0 to 10 percent passing.
      3) Fine aggregate shall stay in suspension within the mix to the extent required for desired flowability.
   d. Course aggregate: Conform to AASHTO M80.
   e. Granulated blast furnace slag: Conform to AASHTO M302.
   f. Lightweight aggregate: Conform to AASHTO M195.
   g. Water: Conform to AASHTO M157.
   h. Chemical admixtures: Conform to AASHTO M194.

i. Air entrainment admixutres: as approved by the Engineer.
j. Foaming admixture: Conform to ASTM C869.

B. Mix design:
1. Flowability:
a. Normal flowable material shall have a flow of 6 to 8 inches, when tested in accordance with ASTM D6103.
b. Low flowable material shall have a maximum flow of 6 inches.
c. High flowable material shall have a minimum flow of 8 inches.
2. Unconfined compressive strength:
a. Excavatable: Between 40 psi and 150 psi at 28 days.
b. Non-excavatable: Between 150 psi and 1,200 psi at 28 days.
3. Permeability: 0.004 cm/sec.

PART 3 EXECUTION

3.1 PLACEMENT OF FLOWABLE FILL

A. Flowable fill shall be discharged from the mixer by any reasonable means into the area/void space to be filled.

B. The fill shall be brought up uniformly to the top elevation of the existing structure to remain, or top of form, as shown on the Contract Drawings.

C. Placement of fill shall then cease for a period of 24 hours before any further construction operations proceed.

D. When placing CLSM for utility backfill, discharge the material on the pipe crown so material is evenly placed on each side of the pipe.

E. Prior to mixing any flowable fill backfill material, the Contractor shall submit to the Engineer a mix design and laboratory test results or historical test data from previous projects using a similar flowable fill mixture.

F. All equipment for this Work shall be subject to the approval of the Engineer at all times.

G. The plant shall be either a continuous or batch type plant, designed to proportion either by weight or by volume, such that a uniform mix will result.

H. Sewer abandonment:
1. Prior to placing flowable fill in gravity sanitary sewer lines to be abandoned in place, cap or plug the downstream end of the sewer line.
2. Disconnect and cap all laterals that connect to the sewer line to be abandoned.

3.2 LIMITATION OF OPERATIONS

A. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, when the temperature is at least 34 degrees F and rising.

B. At time of placement, mortar must have a temperature of at least 40 degrees F. Mixing and placing shall stop when the temperature is 38 degrees F or less and falling.

C. Each filling stage shall be as continuous an operation as is practicable.

D. Do not place CLSM containing fly ash in direct contact with cast iron or ductile iron pipes, fittings, or appurtenances.

E. Do not place CLSM in contact with aluminum pipe, including connections, fixtures, unless the aluminum has been thoroughly coated with zinc chromate primer.

F. Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.

G. Verify field measurements before installing flowable fill to establish quantities required to complete Work.

3.3 CLEANING

A. Remove spilled and excess flowable fill from Project Site.

B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

++ END OF SECTION++

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SECTION 31 3700
RIPRAP

PART 1 GENERAL

1.1 SUMMARY

A. This specification includes the material requirements for riprap and stone fill where called on the Drawings.

1.2 REFERENCE STANDARDS

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. C94, Standard Specification for Ready-Mixed Concrete.
      b. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
      c. C150, Standard Specification for Portland Cement.
      d. C535, Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
      e. D5519, Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials

1.3 SUBMITTALS

A. Action submittals:
   1. Shop drawings:
      a. Description and location of proposed sources of riprap bedding and riprap.
      b. Description and location of three projects where proposed riprap has been successfully used for minimum 3 years' duration under similar service conditions.
   2. Samples:
      a. General:
         1) Deliver to Site at location designated by the Engineer.
         2) Incorporate samples into the Work after material placement is nearly complete.
      b. Riprap:
         1) Each sample shall meet gradation requirements specified for corresponding riprap type, include at least one piece of maximum size, and be representative of material to be furnished for incorporation into the Work.

2) Weigh individual pieces of riprap with scales that are certified accurate to within plus or minus 1 percent of actual weight.

B. Informational submittals:
1. Quarry Certificate of Conformance and supporting documentation showing proposed riprap bedding or riprap meet the Standard Specifications gradation and material requirements for Class or Type specified.
2. Certified Test Results:
a. Riprap Bedding:
1) Gradation.
2) Abrasion resistance.
b. Riprap:
1) Gradation.
2) Abrasion resistance.
3) Bulk density.
3. Trip tickets showing source, type, and weight of each load of material delivered to the Site.

1.4 QUALITY ASSURANCE

A. Riprap source: Quarry that has produced riprap and has performed satisfactorily on other projects for at least 5 years.

B. Site visit: Make arrangements for the Engineer to visit the quarry site to observe materials proposed for riprap and riprap bedding.

1.5 SCHEDULING AND SEQUENCING

A. Complete subgrade preparation as specified elsewhere prior to placing riprap bedding or riprap.

PART 2 PRODUCTS

2.1 AGGREGATE RIPRAP BEDDING

A. Riprap bedding shall consist of gravel with cobbles or crushed rock with cobble-sized pieces:

B. Gradation, as determined in accordance with ASTM C136:
1. Well-graded from coarse to fine.
2. All pieces pass a 6-inch square opening.
3. Minimum 85 percent by weight passing a 4-inch square opening.
4. Minimum 10 percent by weight passing a No. 4 U.S. standard sieve.

C. Abrasion resistance: Maximum 35 percent wear when tested in accordance with ASTM C535.

D. Riprap bedding shall be free of roots and other organic or deleterious matter.

E. Onsite material from excavations or designated borrow sources that meets or is processed to meet the requirements specified above may be used as riprap bedding in lieu of importing material

2.2 RIPRAP

A. Hard and durable quarry stone free from fractures, bedding planes, pronounced weathering, and earth or other adherent coatings.

B. Minimum dimension of individual pieces: Not less than one-third (1/3) maximum dimension.

C. Abrasion resistance: Maximum 35 percent wear as determined in accordance with ASTM C535.

D. Bulk density: Minimum 160 pounds per dry cubic foot.

E. Gradation: Smaller pieces shall generally fill voids between larger pieces without either excess or deficiency of one or more sizes of stone.
   1. Type 1:
      a. Smaller than 8 inches: 90-100 percent.
      b. Larger than 3 inches: 50-100 percent.
      c. Smaller than No. 10 sieve: 0-10 percent.
   2. Type 2:
      a. Lighter than 100 pounds: 90-100 percent.
      b. Larger than 6 inches: 50-100 percent.
      c. Smaller than 1/2-inch: 0-10 percent.
   3. Type 3:
      a. Heavier than 100 pounds: 50-100 percent.
      b. Smaller than 4 inches: 0-10 percent.
   4. Type 4:
      a. Heavier than 600 pounds: 50-100 percent.
      b. Smaller than 6 inches: 0-10 percent.

2.3 CONCRETE GROUT

A. Lean concrete mix in accordance with Section 03 3000, Site Cast in Place Concrete.

PART 3 EXECUTION

3.1 PLACING RIPRAP BEDDING

A. Place riprap bedding over prepared subgrade to lines and grades shown.

B. No mechanical compaction of riprap bedding is required; however, work riprap bedding as necessary to distribute it and to eliminate detrimental voids.

C. Avoid overworking or long pushes that result in segregation of particle sizes.

D. Grade surface of riprap bedding free from irregularities and to tolerances of +/-0.2 feet from established grade.

E. Place and grade riprap bedding in a manner that avoids subgrade disturbance.

3.2 PLACING RIPRAP ON RIPRAP BEDDING

A. Place riprap over riprap bedding to uniform depth as shown.

B. Intermix different sizes of pieces to eliminate segregation and to fill voids between larger pieces with smaller pieces and work surface free from irregularities.

C. Use placement and intermixing methods that avoid disturbing prepared subgrade and riprap bedding or damaging existing facilities, completed Work or adjacent property.

3.3 GROUTING RIPRAP

A. Remove dirt and foreign substances from surfaces or riprap and then moisten.

B. Deposit grout by means of chutes, tubes, or buckets, nor place by means of pneumatic equipment or other mechanical methods.

C. Place grout in a continuous operation for any day’s run at any one location.

D. Limit flow distance of grout along slope to less than 10 feet.

E. Spade and rod grout into place with suitable spades, trowels, or other approved means immediately after depositing grout.

F. Depths of grout shall be approximately 1/2 the thickness of the riprap.

G. Following placement of grout, thoroughly brush rocks so top surfaces are exposed.

H. Outer rocks shall project 1/3 to 1/4 their diameter above grout surface.

I. Brushing shall follow closely behind rodding such that grout shall not be in place more than one (1) hour before brushing.

J. Once brushing of area is complete, no worker or load will be permitted on the surface for a period of at least 24 hours, or longer if so required by the Engineer.

K. Cure grout in accordance with Section 03 3000, Site Cast in Place Concrete.

++END OF SECTION++

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SECTION 31 4100
SHORING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all material and performance requirements to provide temporary shoring for structural excavations, trenching, and other incidental excavations where the Contractor's Competent Person deems in need of support.

1.2 REFERENCE STANDARDS

A. 29 CFR 1926.650, Safety and Health Regulations for Construction.

1.3 SUBMITTALS

A. Informational submittals.
   1. Submit the following:
      a. Excavation support plan.
      b. Movement monitoring plan.
      c. Trench excavation plan.
      d. Movement measurement and data and reduced results indicating movement trends.
   2. The Contractor shall submit erection drawings and calculations signed and sealed by a Professional Engineer licensed in New York State for all Contractor-designed temporary shoring and excavation support systems.

1.4 QUALITY ASSURANCE

A. Provide surveys to monitor movements of critical facilities.

PART 2 PRODUCTS

(NOT USED)

PART 3 EXECUTION

3.1 GENERAL

A. Design, provide, and maintain shoring, sheeting, and bracing as necessary to support the sides of excavations and to prevent detrimental settlement and

lateral movement of existing facilities, adjacent property, and the completed Work.

3.2 EXCAVATION SUPPORT PLAN

A. Prepare excavation support plan addressing the following aspects:
   1. Details of shoring, bracing, sloping and other provisions for worker protection from hazards of caving ground.
   2. Design assumptions and calculations.
   3. Methods and sequencing of installation excavation support.
   4. Proposed locations of stockpiled excavated material.
   5. Minimum lateral distance from the crest of slopes for vehicles and stockpiled excavated materials.
   6. Anticipated difficulties and proposed resolutions.

3.3 MOVEMENT MONITORING PLAN

A. Prepare movement monitoring plan addressing the following aspects:
   1. Survey control.
   2. Location of monitoring points.
   3. Plots of data trends.
   4. Interval between surveys.

3.4 REMOVAL OF EXCAVATION SUPPORT

A. Remove excavation support in a manner that will maintain support as excavation is backfilled.

B. Do not begin to remove excavation support until support can be removed without damage to existing facilities, completed Work, or adjacent property.

C. Remove excavation support in a manner that does not leave voids in the backfill.

3.5 TRENCHES

A. Provide trench excavations exceeding 4 feet in depth with adequate safety systems meeting the requirements of 29 CFR 1926.650 and applicable State laws.

++END OF SECTION++

SECTION 32 1123
AGGREGATE BASE COURSES FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes performance and material requirements for aggregate subbase for roadway construction.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft).
   2. D2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
   3. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Materials Source: Name of aggregate materials suppliers.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout Work.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

A. Subbase aggregate: Granular Fill as specified in Section 31 0516, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted substrate is dry and ready to support paving and imposed loads.

B. Proof-roll substrate with in minimum two perpendicular passes to identify soft spots.

C. Remove soft substrate and replace with compacted fill as specified in Section 31 2323, Fill.

D. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

A. Install geotextile fabric over subgrade according to manufacturer's instructions.

B. Lap ends and edges minimum 6 inches.

C. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.

D. Place aggregate equal thickness layers to total compacted thickness indicated on Contract Drawings.

E. Maximum Layer Compacted Thickness: 8 inches.

F. Minimum Layer Compacted Thickness: 3 inches.

G. Roller compact aggregate to 95 percent maximum density.

H. Level and contour surfaces to elevations, profiles, and gradients indicated.

I. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.

J. Maintain optimum moisture content of fill materials to attain specified compaction density.

Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Maximum variation from flat surface: 1/2 inch measured with 10 foot straight edge.

B. Maximum variation from thickness: 1/4 inch.

C. Maximum variation from elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Compaction testing will be performed according to ASTM D6938.

B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

C. Frequency of tests: One test for every 1000 sq. yd. of each layer compacted aggregate.

3.6 COMPACTION

A. Compact materials to 95 percent of maximum density as determined from test strip, according to ASTM D1557.

++END OF SECTION++

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SECTION 32 1216
ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes all material and performance requirements for asphalt paving materials as called on the Drawings, including:
   1. Asphalt paving base course.
   2. Binder course.
   3. Top course or surface course.
   4. Tack coats.

B. See Section 32 1123, Aggregate Base Courses For Exterior Improvements for aggregate base course requirements.

1.2 REFERENCE STANDARDS

A. The following is a list of standards which may be referenced in this Section:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M17, Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
      b. M81, Standard Specification for Cut-Back Asphalt (Rapid Curing Type).
      c. M82, Standard Specification for Cut-Back Asphalt (Medium Curing Type).
      d. M140, Standard Specification for Emulsified Asphalt.
      e. M208, Standard Specification for Cationic Emulsified Asphalt.
      f. T166, Standard Method of Test for Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens.
      g. T176, Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.
      h. T230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
      i. T245, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
      j. T246, Standard Method of Test for Resistance of Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
      k. T247, Standard Method of Test for Preparation of Test Specimens of Bituminous Mixtures by Means of California Kneading Compactor.

l. T283, Standard Method of Test for Resistance of Compacted Bituminous Mixture to Moisture-Induced Damage.
m. T304, Standard Method of Test for Uncompacted Void Content of Fine Aggregate (Method A).

2. Asphalt Institute (AI):
   a. Manual Series No. 2 (SP-2), Mix Design Methods for Asphalt Concrete.
   b. Superpave Series No. 2 (SP-2), Superpave Mix Design.
3. ASTM International (ASTM):
   a. D4318, Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   b. D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
   c. D5281, Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
   d. E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
4. State of New York Department of Transportation, Standard Specifications.

1.3 DEFINITIONS

A. Combined aggregate: All mineral constituents of asphalt concrete mix, including mineral filler and separately sized aggregates.

B. RAP: Reclaimed asphalt pavement.

C. Standard Specifications: State of New York Department of Transportation (NYSDOT) Standard Specifications dated September 1, 2022.

1.4 DESIGN REQUIREMENTS

A. Prepare asphalt concrete mix design, meeting the Standard Specifications.

B. All thicknesses of pavement courses described herein or shown on the Drawings represent compacted thicknesses.

1.5 SUBMITTALS

A. Informational submittals:
   1. Test report for asphalt concrete:
      a. Submit a minimum 10 days prior to start of production.
      b. Show appropriate test method(s) for each material and the test results.
   2. Manufacturer’s Certificate of Compliance for the following materials:

a. Aggregate: gradation, source test results as defined in Section 703 of the NYSDOT Standard Specifications.
b. Asphalt for binder: Type, grade, and viscosity-temperature curve.
c. Tack coat: Type and grade of asphalt.
d. Additives.
e. Mix: Conforms to job-mix formula.

3. Statement of qualification for independent testing laboratory.
4. Test results:
   a. Mix design.
   b. Asphalt concrete core.
   c. Gradation and asphalt content of uncompacted mix.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with the Standard Specifications as amended and/or supplement herein.

B. Qualifications:
1. Independent Testing Laboratory: In accordance with ASTM E329.
2. Asphalt concrete mix formula shall be prepared by approved, certified independent laboratory under the supervision of a certified asphalt technician.

C. Compaction control strip:
1. General:
   a. Construct to approximately 4,300 square feet in area and at a location that will become a portion of the completed paved area.
   b. Thickness: Typical thickness to be paved on the Project.
2. Rollers used for compaction:
   a. Steel wheel rollers: Minimum static weight of 10 tons.
   b. Pneumatic rollers: Capable of exerting pressure of 80 psi on bituminous surface.
   c. Vibratory rollers: Minimum static weight of 6 tons, capable of applying a 10-ton impact force equipped with amplitude and frequency control specifically designed for compaction of bituminous mixtures.
3. Compaction:
   a. Compact bituminous mat using standard rolling patter that covers the entire control strip. Request that the Engineer performs a final density test.
   b. Continue rolling until no further compaction can be obtained as determined by field density testing.

c. Temperature and condition of bituminous mat shall be considered workable when further compaction can no longer be obtained.

4. Target density determination:
   a. Select test point near center of normal roller pass, but no closer than 2 feet from the edge of mat and 50 feet from each end of the control strip. Mat thickness at this point shall be at least the depth of the finished pavement.
   b. This shall be the point at which no further densification can be obtained.
5. Establish a new target density if changes are made in the mix design, nominal depth of mat being placed, aggregate source, or material properties.

1.7 AMBIENT CONDITIONS

A. Weather and seasonal limitations shall comply with the Standard Specifications. NYSDOT Standard Specifications Section 402-3.01.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mixtures: designed in accordance with NYSDOT standards:
   1. Top Course: 1.5” Item No. 402.128303 12.5 F3 Top Course HMA.
   2. Binder Course: 2.5” Item No. 402.198903 19 F9 Binder Course HMA.
   3. Subbase Course: Item 304.12, Subbase Course, Type 2

B. Tack coat:
   1. Shall be applied between all lifts of HMA courses and where new asphalt meets existing asphalt or concrete.
   2. Comply with the requirements of NYSDOT Section 702 Bituminous Materials

2.2 ASPHALT CONCRETE MIX

A. General:
   1. Mix formula shall not be modified except with written approval of the Engineer.
   2. Source changes:
      a. Should material source(s) change, establish new asphalt concrete mix formula before new material(s) is used.
      b. Perform check tests of properties of plant-mix bituminous materials on first day of production and as requested by the

Engineer to confirm that properties are in compliance with design criteria.

c. Make adjustments in gradation or asphalt content as necessary to meet design criteria.

B. Asphalt concrete: as specified in Section 402 of the Standard Specifications.

C. Composition:
1. Hot-mix asphalt plant of aggregate, mineral filler if required, and paving grade asphalt cement.
2. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that resulting mixture meets grading requirements of the mix.

D. Aggregate:
1. General: as specified in Section 703 of the Standard Specifications.

E. Mineral filler: in accordance with Section 703-08 of the Standard Specifications.

F. Asphalt cement: Paving grades 18-60, as specified in Section 702 of the Standard Specifications.

PART 3 EXECUTION

3.1 GENERAL

A. Traffic control:

1. Minimize inconvenience to traffic, but keep vehicles off freshly-treated or paved surfaces to avoid pickup and tracking of asphalt.

B. Driveways: Repave driveways from which pavement was removed. Leave driveways in as good or better condition than before start of construction.

3.2 LINE AND GRADE

A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.

B. Shoulders: Construct to line, grade, and cross-section shown.

3.3 APPLICATION EQUIPMENT

A. In accordance with the Standard Specifications.

3.4 PREPARATION

A. Prepare subgrade and subbase in accordance with the Standard Specifications and as supplemented herein.

B. Existing Roadways:
   1. Modify profile by grinding, milling, or overlay methods as approved, to provide meet lines and surfaces and to produce smooth riding connection to existing facilities.
   2. Remove existing material to a minimum depth of 1 inch.
   3. Paint edges to meet line with tack coat prior to placing new pavement.

C. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.5 PAVEMENT APPLICATION

A. General: Place asphalt concrete mixture on approved, prepared subbase or base as applicable in accordance with the Standard Specifications and as shown on the Drawings.

B. Tack coat:
   1. Prepare material, as specified in the Standard Specifications prior to application.
   2. Apply uniformly to clean, dry surfaces avoiding overlapping of applications.
   3. Do not apply more tack coat than necessary for the day's paving operation.
   4. Touch up missed or lightly-coated surfaces and remove excess material.
   5. Application rate: Minimum 0.05 to 0.06 gallons per square yard of asphalt (residual if diluted emulsified asphalt) of surface area or as specified in the Standard Specifications, whichever is greater.

C. Pavement mix:
   1. Prior to paving:
      a. Sweep primed surface free of dirt, dust, or other foreign material.
      b. Patch holes in tack-coated surface with asphalt concrete pavement mix.
      c. Blot excess tack material with sand.
   2. Total compacted thickness: As shown on the Drawings.
   3. Apply such that meet lines are straight and edges are vertical.
   4. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.

5. Joints:
   a. Offset edge of each layer a minimum of 3 inches so joints are not directly over the underlying layer.
   b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
   c. Form transverse joints by cutting back on the previous day's run to expose full vertical depth of layer.
6. Succeeding lifts: Apply tack coat to pavement surface between each lift.
7. After placement of pavement, seal meet line by painting a minimum of 6 inches on each side of the joint with cut-back or emulsified asphalt. Cover immediately with sand.

D. Compaction:
1. Comply with the requirements of the Standard Specifications.
2. Joint compaction shall follow the requirements the Standard Specifications.

E. Tolerances: Tolerances shall comply with the Standard Specifications.

F. Seal coat:
1. General: Apply seal coat of paving grade or emulsified asphalt to finished surface at longitudinal and transverse joints, joints at abutting pavements, areas where asphalt concrete was placed by hand, patched surfaces, and other areas as directed by the Engineer.
2. Preparation:
   a. Surfaces that are to be sealed shall be maintained free of holes, dry, and clean of dust and loose material.
   b. Seal in dry weather and when temperature is above 35 degrees F.
3. Application:
   a. Fill cracks over 1/16-inch in width with asphalt-sand slurry or approved crack sealer prior to sealing.
   b. When sealing patched surfaces and joints with existing pavements, extend a minimum of 6 inches beyond edges of patches.

3.6 PAVEMENT OVERLAY

A. Preparation:
1. Pavement overlay preparation shall comply with the Standard Specifications.

B. Application:

1. Pavement overlay application shall comply with the Standard Specifications.

3.7 PATCHING

A. Preparation:
   1. Remove damaged, broken, or unsound asphalt concrete adjacent to patches.
   2. Trim straight lines exposing smooth, sound, vertical edges.
   3. Prepare patch subgrade as specified in the Standard Specifications.

B. Application:
   1. Patch thickness: 3 inches or thickness of adjacent asphalt concrete, whichever is greater.
   2. Place asphalt concrete mix across full width of patch in layers of equal thickness.
   3. Spread and grade asphalt concrete with hand tools or mechanical spreader, depending on size of area to be patched.

C. Compaction: Follow compaction requirements specified in the Standard Specifications.

D. Tolerances: Comply with the Standard Specifications.

3.8 FIELD QUALITY CONTROL

A. General: Provide the services of an approved certified independent testing laboratory to conduct tests.

B. Field density tests:
   1. Perform tests from cores or sawn samples in accordance with AASHTO T230 and AASHTO T166.
   2. Measure with properly operating and calibrated nuclear density gauge in accordance with ASTM D2950.
   3. Maximum density: In accordance with ASTM D2041, using sample of mix taken prior to compaction from the same location as density test sample.

C. Testing frequency:
   1. Quality control test:
      a. Asphalt content, aggregate gradation: once per every 500 tons of mix or once every 4 hours, whichever is greater.
      b. Mix design properties, measured maximum (Rice's) specific gravity: Once every 1,000 tons or once every 8 hours, whichever is greater.

2. Density tests: Once every 500 tons of mix or once every 4 hours, whichever is greater.

++END OF SECTION++

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SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes performance and material requirements for reinforced and unreinforced concrete paving for:
   1. Roadways.
   2. Parking areas.
   3. Driveway aprons.
   4. Sidewalks.
   5. Slip-formed curbs and gutters.

B. Related Work specified elsewhere:
   1. Section 31 2213, Subgrade Preparation.
   2. Section 32 1123, Aggregate Base Courses for Exterior Improvements.
   3. Section 32 1723, Pavement Markings.
   4. Section 33 0561, Concrete Manholes.

C. Definitions:
   1. Standard Specifications: State of New York Department of Transportation (NYSDOT) Standard Specifications.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. M6, Standard Specification for Fine Aggregate for Portland Cement Concrete.
   2. M80, Standard Specification for Coast Aggregate for Portland Cement.
   3. M153, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
   4. M157, Standard Specifications for Ready-Mix Concrete.
   5. M213, Standard Specification for Preformed Expansion Joint.
   6. M227, Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
   7. M324, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute (ACI):
   1. 301, Specifications for Structural Concrete.
   2. 305R, Hot Weather Concreting.

3. 306R, Cold Weather Concreting.
4. 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
5. 308, Standard Practice for Curing Concrete.
6. 318/318R, Building Code Requirements for Structural Concrete and Commentary.
7. 325.9R, Guide for Construction of Concrete Pavements and Concrete Bases.

C. ASTM International (ASTM):
1. A184, Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
2. A185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
3. A497, Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
4. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
5. A706, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
6. A767, Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
7. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
8. A884, Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
9. A934, Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
10. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
11. C33, Standard Specification for Concrete Aggregates.
12. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
14. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
15. C94, Standard Specification for Ready-Mixed Concrete.
16. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
17. C150, Standard Specification for Portland Cement.
18. C172, Standard Practice for Sampling Freshly Mixed Concrete.
19. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

20. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
21. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
22. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
23. C494, Standard Specification for Chemical Admixtures for Concrete.
24. C595, Standard Specification for Blended Hydraulic Cements.
25. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
26. C803, Test Method for Penetration Resistance of Hardened Concrete.
27. C805, Test Method for Rebound Number of Hardened Concrete.
28. C979, Standard Specification for Pigments for Integrally Colored Concrete.
29. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
30. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
31. C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
32. C1116, Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
33. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
34. C1330, Specification for Cylindrical Seal Backing for Use with Cold Liquid Applied Sealants.
35. C1371, Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
36. C1549, Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
37. D920, Standard Specification for Elastomeric Joint Sealants.
38. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
39. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
40. D1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
41. D2628, Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete.
42. D2828, Specification for Non-Bituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavement, Sawable Type.

43. D3406, Specification for Joint Sealant, Hot-Applied, Elastomeric, Jet Fuel Resistant Type for Portland Cement Concrete Pavements.
44. D3569, Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.
45. D3581, Specification for Joint Sealant, Hot-Applied, Jet-Fuel-Resistant-Type, for Portland Cement and Tar-Concrete Pavements.
46. D5249, Specification for Backer Material for Use With Cold- and Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints.
47. D5893, Specification for Cold-Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
48. D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
49. E329, Specification for Agencies Engaged in Testing and Inspection of Materials Used in Construction.
50. E408, Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
51. E903, Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
52. E1918, Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
53. E1980, Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

D. National Ready Mixed Concrete Association (NRMCA).

1.3 SUBMITTALS

A. Action submittals:
   1. Product data: admixtures.
   2. Design data:
      a. Concrete mix design signed by concrete mix designer.
      b. Minimum information:
         1) Name of ready-mix plant.
         2) Project.
         3) Engineer.
         4) Contractor.
         5) Mix design number.
         6) Specified concrete strength.
         7) Water-cement-fly ash ratio.
         8) Maximum aggregate size.
         9) Cement content.
         10) Fly ash content.
         11) Water content.

12) Type, name, and amount of admixtures.
13) Unit weight.
14) Slump.
15) Ingredient proportions corrected for average moisture content for particular times of year.

3. Joint drawings: Identify location and spacing of each type of joint.
4. Gradation for coarse and fine aggregates, and combined gradation. List percent passing for each sieve size.
5. Detailed plan for cold weather placements, including curing and protection.
6. Detailed plans for hot weather placements, including curing and protection.

B. Informational submittals:
1. Manufacturer's Certificate of Compliance:
a. Portland cement.
b. Admixtures.
c. Fly ash.
d. Aggregates.
2. Statements of Qualifications:
a. Mix designer.
b. Batch plant.
c. Testing laboratory.
3. Test reports:
a. Admixtures: Chemical ingredients and percentage of chloride in each admixture and fly ash.
b. Fly ash: Source test analysis and amount used in accordance with ASTM C94, Section 16.
c. Mix design: for each trial, signed by qualified mix designer.
d. Laboratory mixes: cylinder test results.
4. Concrete delivery tickets:
a. For each batch of concrete before unloading at the Site.
b. Minimum delivery ticket information:
1) Name of ready-mix plant.
2) Serial number of ticket.
3) Date and truck number.
4) Name of Contractor.
5) Job name and location.
6) Mix design number.
7) Quantity of concrete delivered.
8) Type and quantity of admixtures.
9) Quantity of water added at batch plant.
10) Time of loading, arriving at the Site, and unloading.
11) Volume of water added by receiver of concrete at their initials.

c. Record of drum revolution counter, type, and brand.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Mix Designer: Licensed professional engineer registered in New York State or a certified concrete mix designer approved by NYSDOT.
2. Testing and Inspection Agency: Comply with ASTM E329.
3. Batch plant: Currently certified by the National Ready Mixed Concrete Association.

B. Pre-Paving conference:
1. Hold among the Contractor, Subcontractor involved in concrete paving and the Engineer.
2. Hold conference at least 14 days prior to the start of concrete paving operations.
3. Conference cannot be held until the Engineer has received concrete mix design and admixture submittals.
4. Items to be discussed:
a. Mix design.
b. Method of placement.
c. Curing.
d. Finishing schedule.
e. Traffic control.
f. Protection of Work.

C. Hot Weather Concreting: Conform to ACI 305R.

D. Cold Weather Concreting: Conform to ACI 306R.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Transport ready-mix concrete in accordance with ASTM C94.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Concrete mix design:
1. The requirements of the following sections of the NYSDOT Standard Specifications shall apply unless otherwise indicated on the Drawings:
a. Portland cement: 701-01.
b. Coarse aggregate: 703-02.

c. Concrete sand: 703-07.
d. Admixtures: 711-08.
e. Water: 712-01.

2. Compressive strength: 4,000 psi at 28 days.
3. Air entrainment: 5% to 7%.
4. Maximum water-cement ratio: 0.44.
5. Maximum slump: 4 inches.

2.2 ANCILLARY MATERIALS

A. Tie bars: Grade 40 deformed steel bars, conforming to Section 03 2100, Reinforcing Steel.

B. Dowels: Conform to the requirements of AASHTO M227, Grade 70.

C. Joint filler:
1. Contraction joints shall be placed between expansion joints at equal intervals not exceeding six (6) feet.
2. These joints shall be formed either by use of steel division plates, 1/8-inch thick, or by approved methods of cutting a groove in the surface of the finished concrete.
3. Expansion joints shall be pre-molded strips of asphaltic felt of the required thickness, as wide as the thickness of the walk, and laid in one piece as long as the full length of the slab.

D. Joint sealant:
1. Shall be a one-component, non-priming, urethane, self-leveling (pour grade) sealant.
2. Joint sealant material shall fully comply with Federal Specification TT-S-00230C, Type 1, Class A, and ASTM C920, Type S, Grade P, Class 25, Use T, M.

E. Backer rod:
1. Backer material conforming to ASTM D5249.
2. Cylindrical sealant backing conforming to ASTM C1330.

F. Curing compound: Per NYSDOT Standard Specifications, Section 701.

G. Curing membranes:
1. White, polyethylene sheet.
2. Waterproof paper.
3. Cotton or jute mats.

H. Evaporation retardant: Confilm, as manufactured by Master Builders Company, or approved equal.

2.3 EQUIPMENT

A. Ready-mixed concrete batch plants: Certified by NYSDOT.

B. Batch plants:
1. Conform to requirements of Section 701 of the NYSDOT Standard Specifications.
2. Bins shall have adequate separate compartments for fine aggregate, each separate size of coarse aggregate and cement.
3. Bins and compartments shall be tight and ample to prevent spilling from one bin to another.
4. Separate compartments, including weighing hoppers, shall discharge freely and efficiently.
5. Scales for weighing aggregates and cement may be either beam type or springless dial type.
6. Scales shall be accurate within 0.5 percent under operating conditions throughout the range of use and, tested and adjusted as often as the Engineer may deem necessary to assure their continued accuracy.
7. Equipment for dispensing water and admixtures shall provide a separate feed, accurate quantity measurement, and shall inject water and admixture at a time in the mixing process to ensure thorough and complete mixing throughout the batch.
8. Automatically controlled batchers shall have automatically interlocked mechanisms providing the following:
    a. Positive weighing and discharge of cement and of each separate size aggregate.
    b. Interlocking between weighing hoppers to prevent part of batch from being discharged until each separate hopper has been filled with correct proportion.
    c. Simultaneous discharge of hoppers.
    d. Lockable compartment containing time setting controls.
9. Equip mixers with a timing device that will not permit batch to be discharged until specified mixing time has elapsed.
10. The means of storing, measuring and introducing water into the mixer shall provide positive control and accurate measurement.

C. Ready-mixed concrete trucks:
1. As specified in Section 701 of the NSDOT Standard Specifications.
2. Agitator mixer type.
3. Equipped with operable electrically-actuated drum revolution counter.
4. Use of non-agitator equipment is will not be permitted.
5. Each mixer shall carry a clearly visible manufacturer’s plate showing capacity of mixer and other pertinent operating rates and limits.
6. Provisions shall be made at the mixer for controlled addition of air-entraining admixtures or other special components of the mix.

7. Mixing speed: 70 to 100 revolutions at a mixing speed recommended by the truck mixer manufacturer.

D. Hauling equipment:
   1. As specified in Section 701 of the NYSDOT Standard Specifications.
   2. Upon delivery of each batch of concrete to the Site, submit a trip ticket to the Engineer.

E. Paving equipment:
   1. Slipform paver:
      a. Place concrete paving with two separate machines, a spreader and a slipform paver. Machines, when operating in tandem shall spread, consolidate, screed, and float finish freshly placed concrete paving in one pass with a minimum of hand-finishing.
      b. Each machine shall be fully self-propelled and equipped with electronic controls to control line and grade from both sides.
      c. Spreader shall be able to deliver mix without segregation or displacing reinforcing steel.
      d. Able to vibrate concrete paving for full width and depth and be equipped with vibrating tubes or arms to work in concrete paving.
      e. Sliding forms shall be held together rigidly to prevent them from spreading.
      f. Form shall be long enough so concrete slump will not exceed 1/4-inch.
      g. Supports of paver and other equipment which ride on previously-placed pavement shall be equipped to prevent marring, edge breaking, or chipping of previously placed pavement.
   2. Bridge deck finisher/paver: A bridge or similar finishing/paving machine utilizing previously constructed and cured curb and gutter as side forms and support for machine rails may be used with prior approval of the Engineer.

F. Concrete saws:
   1. Provide power-driven concrete saws for sawing joints or finishing concrete, adequate in number of units and power to complete sawing at required rate.
   2. Saws and related equipment shall be of proven adequacy and design to perform efficiently and shall be subject to immediate replacement, if specified results are not obtained.
   3. Standby saw shall be available at the Site.

G. Smoothness testing equipment: Supply two 12-foot straight edges for determining smoothness.

PART 3 EXECUTION

3.1 WEATHER LIMITATIONS

A. Concrete shall not be placed:
   1. Until the air temperature in the shade is 40 degrees F and rising and is forecast to remain above 40 degrees F.
   2. On frozen ground.
   3. During periods of rain or snow.

B. Concrete placement shall not continue when air temperature drops below 40 degrees F.

C. Protect concrete pavement from inclement weather for 7 days after it has been placed, when rain is imminent, and when air temperature drops or is forecast to drop below 40 degrees F.

3.2 PREPARATION

A. Prepare base as specified in Section 304 of the NYSDOT Standard Specifications.

B. Dampen base thoroughly prior to concrete placement; standing water will not be permitted.

C. Complete formwork prior to concrete placement. Area in which concrete is to be placed shall be smooth and free of ruts, projections, debris, spilled concrete, mud, sloughed soil, standing water, organic and other objectionable materials.

D. Construction joints: Inspect prior to concrete placement.

E. Prior to placing paving equipment in position, full width and length of the area on which the tracks of the paving equipment is to operate shall be brought to density and surface tolerances required.

F. Protect existing exposed surfaces such as grates, catch basins, air valves, manholes, and clean-out lids from splattered and spilled concrete during concrete placement by use of durable waterproof paper.

G. Furnish operable backup vibrator on Site prior to concrete placement.

3.3 SLIP-FORM PAVING

A. Deliver from hauling vehicle to paving machine hopper.

B. Contractor's equipment hauling Portland cement concrete or reinforcement will not be permitted on prepared subgrade, but will be allowed on the base, with turns or other maneuvering kept to a minimum. Damage to subgrade or base shall be corrected to the satisfaction of the Engineer.

C. Machine placement:
1. Place in final position uniformly in one layer, so a minimum of finishing will be necessary to provide a dense, homogenous pavement conforming to true grade and cross-section.
2. Spreader shall receive Portland cement concrete mixture in its hopper and uniformly spread and strike it off at proper thickness for full width of area being paved.
3. Paver shall vibrate, consolidate, and finish slab to proper grade and cross-section.

D. Paver:
1. Paver shall be operated with as continuous forward movement as possible.
2. Coordinate mixing, delivering, and spreading Portland cement concrete to provide uniform progress.
3. Stopping and starting paver shall be held to a minimum.
4. If for any reason it is necessary to stop forward motion of the paver, vibratory and tamping elements shall also be stopped immediately.
5. No external force shall be applied to the paver, except with approval of the Engineer.

E. While placing Portland cement concrete, make provisions for construction joints, placing dowels, tie bars, and other devices, as called on the Drawings, and as specified herein.

F. Portland cement concrete shall be rejected if it:
1. Is not in place within 1 hour after being mixed.
2. Has begun to take an initial set prior to placement.
3. Has been re-tempered with water.

G. If necessary, supplemental hand spreading and distributing shall be with shovels. Rakes will not be permitted.

H. Portland cement concrete shall not be fouled with foreign matter.

I. Use vibrators to consolidate Portland cement concrete pavement at least 6 feet each side of construction joints and expansion joints.

J. Defects:

1. Fill areas of minor honeycomb or other minor defect in composition of Portland cement concrete along exposed edges of Portland cement concrete with a stiff mortar of cement and fine aggregate.
2. Apply to moistened Portland cement concrete to satisfaction to Engineer.
3. Areas showing serious defects of concrete composition shall be removed and replaced with pavement of specified quality for full width of strip between longitudinal joints or edges and for a length of not less than between the nearest transverse joint.

3.4 JOINTS

A. General:
1. Referred to as contraction or construction, either of which may be transverse or longitudinal, as called on the Drawings or as approved by the Engineer.
2. Joints, backer material, joint filler, and joint sealants shall extend to pavement edges or to each other, and shall be constructed perpendicular to the pavement surface.
3. Joints shall not vary from specified or indicated line by more than 1/4 inch.
4. Joint drawings: Contractor's joint layout submittal shall consider joint placement in curb and gutter, at catch basins, and position of manholes and other large structures, as well as other limitations as specified herein.
5. Place manholes and other similar large structures in line of joint, or if impractical, isolate structure from pavement with pre-molded joint filler, 1/2-inch wide, conforming to AASHTO M213 and ASTM D1751.

B. Contraction joints:
1. Sawed type with poured filler:
   a. Sawing shall be to a depth as shown on the Drawings with a maximum width of 1/4 inch and a minimum width of 1/8 inch, in straight lines as shown or as approved by the Engineer.
   b. Perform saw cuts as soon as concrete pavement has set enough to permit sawing without tearing or raveling, before uncontrolled cracking results, and within 24 hours of placing Portland cement concrete.
   c. Saw by be single or tandem, as the Contractor may elect, and shall be controlled by a guide to a true line.
   d. Clean joints thoroughly of foreign matter before pouring approved rubber asphalt filler.

e. Tops of joint filler shall be true to pavement cross-section within 1/8 inch and shall be protected from damage by concrete paving operations.
f. Areas containing uncontrolled cracks shall be removed and replaced.
g. Restore curing agents broken or damaged by sawing operations.

2. Space longitudinal joints as shown on the Drawings at the interface between lanes, normally at intervals between 12 and 16 feet.
3. Transverse joints shall be as shown on the Drawings or as approved by the Engineer, with intervals of 12 to 16 feet.

C. Construction joints:
1. Construct when there is an interruption of longer than 45 minutes in Portland cement concrete placing operations or where specified.
2. Place parallel with intended contraction joint.
3. Tool both free edges of joints with 1/8 inch radius rounder to remove laitance and mortar resulting from finishing operations and to provide clean, rounded edge.
4. Tooling shall not form ridges on surface of concrete.
5. New concrete pavement placed contiguous to joint shall conform to proportions and consistency of previously placed concrete.
6. Transverse construction joint:
   a. Doweled type by using #8 x 3’-0” long dowels at 12-inch centers coated with plastic, grease, heavy oil or other approved material that will neither bond with nor be harmful to operation at a depth of 1/2 the pavement thickness parallel to the centerline.
   b. If sufficient Portland cement concrete has not been mixed at the time of interruption to place a construction joint at least 3 feet from a planned contraction joint, remove excess Portland cement concrete back to a position to satisfactorily meet these criteria and to satisfaction of the Engineer.
   c. Fill joint which has opened to a width of 1/8 inch or greater during construction or maintenance periods with poured filler.
   d. Do not construct within 3 feet of a transverse contraction joint.
7. Longitudinal construction joint:
   a. Tied type using #5 x 3’-0” deformed tie bars at 12-inch centers.
   b. Tie bars:
      1) Not required at construction joints between concrete pavement and gutter, except where shown on the Drawings and specified herein.
      2) Placement:

a) Plastic concrete: Insert before vibrating and finishing concrete pavement.
b) Hardened concrete:
i) Drill hole, insert, and grout tie bars intoplace.
ii) Drill holes large and deep enough to allow tie bars to be inserted with grout.
iii) Perform any time after concrete pavement has attained enough strength to resist damage caused by drilling.
iv) Tie bars shall be grouted a maximum of 3 hours prior to placement of adjacent concrete pavement.

3) Replace loose tie bars by drilling and grouting as specified herein.

D. Scored joints:
1. Configuration: 1/4-inch wide by 1/4-inch deep at locations indicated on the Drawings, formed by tooling concrete while it is still fresh.
2. Do not fill or seal.
3. Layout of joints shall be straight and true and shall not vary from indicated line by more than 1/4 inch.

3.5 SURFACE FINISHING

A. Use temporary screeds. Wet screeding and jitterbugging shall not be permitted.

B. Pavements shall have a surface tolerance of 1/4 inch in 10 feet, in accordance with ACI 325.9R.

C. Salting, spreading of cement, or cement-sand mixtures to speed up hardening shall not be permitted.

D. Exposed pavement edges shall be edged to a 1/2-inch radius and construction joints shall be edged to 1/8inch radius after finishing. Edging shall not form ridges on pavement surface.

E. Pavement shall be treated and protected by use of evaporation retardant applied in accordance with manufacturer’s written instructions.

F. Flat surfaces shall be treated immediately after screeding and floating or if time period greater than 15 minutes occurs between finishing operations.

G. Pavements shall be screeded, floated, and given a broomed, skid-resistant finish.

3.6 CURING OF CONCRETE PAVEMENT

A. Immediately after final floating, surface finishing, and edging has been completed, and while Portland cement concrete surface is still moist, cover and cure entire expose surface for at least 72 hours in accordance with one of the following provisions:
   1. Liquid Membrane-Forming Compounds:
      a. Apply compound uniformly to Portland cement concrete by pressure-spray methods at a rate which will form an impervious membrane, by at least at a rate of 1 gallon per 150 square feet.
   2. Other membranes:
      a. Apply to damp Portland cement concrete as soon as it can be placed without marring surface.
      b. Place in tact with surface, extend beyond sides or edges of slabs or forms, and fasten down to hold it in position as a waterproof and moisture-proof covering.
      c. Laps shall be sufficient to maintain tightness equivalent to sheeting.
      d. Transverse laps for waterproof shall be at least 18 inches, and longitudinal seams shall be cemented.
      e. Cotton or jute mats shall be saturated with water prior to placing and kept fully wetted during the curing period.

B. Timing and application:
   1. Concrete shall be cured by use of curing compound, for a minimum of 7 days after concrete placement, in accordance with ACI 308.
   2. Curing compounds shall be applied in accordance with the manufacturer's written instructions.
   3. Exposed surfaces shall be sprayed with curing compound immediately after free surface water has disappeared from finished surface.

C. Concrete temperature shall be maintained in accordance with ACI 306R.

D. Curing compounds shall not come into contact with hardened concrete that is to be concreted against.

3.7 FIELD QUALITY CONTROL

A. Retain independent testing or inspection agency to perform inspection, sampling, and testing.

B. Concrete sampling:
   1. In accordance with ASTM C172.
   2. Take sample not less than every 5,000 square feet or fraction thereof of concrete placed each day.

C. Perform the following tests on each sampling:
   1. Slump: ASTM C143.
   2. Air content: ASTM C231.
   3. Compressive strength: ASTM C39.
   4. Flexural strength: ASTM C78.

D. Strength tests:
   1. Make and cure cylinders and beams in accordance with ASTM C31.
   2. Cylinders:
      a. Make four, standard 6-inch diameter by 12-inches high.
      b. Cure on in field and three in laboratory.
   3. Beams:
      a. Make three standard 6 inches by 6 inches by 21 inches.
      b. Cure in the field.
   4. Compressive:
      a. Test one field-cured cylinder at 7 days and two laboratory-cured cylinders at 28 days.
      b. Test last cylinder at 56 days, if 28-day cylinder is below specified strength.
   5. Flexural: Test one beam at 7 days and two beams at 28 days.

E. Acceptance of concrete shall be in accordance with ACI 318/318R.

F. Concrete with compressive strength less than specified, as evidenced by cylinder tested at 56 days, shall be additionally tested as follows:
   1. Less than 500 psi low in compression or less than 75 psi low in flexure:
      a. Penetration Resistance Test: Per ASTM C803.
      b. Rebound Hammer Test: Per ASTM C805.
      c. Perform tests within 24 hours of non-conforming strength tests.
   2. More than 500 psi low in compression or more than 75 psi low in flexure:
      a. Concrete coring: Take three standard cores from the concrete representing original specimens.
      b. Take and prepare cores in accordance with ASTM C42.
      c. Test cores in accordance with ASTM C39.
      d. Take cores within 24 hours of non-conforming strength test.

3.8 CLEANING

A. Clean concrete splatter from exposed surfaces.

B. Thoroughly broom and wash concrete surfaces before opening to traffic.

3.9 PROTECTION OF CONCRETE

A. Do not operate construction equipment or allow traffic on newly placed concrete pavement until the following requirements are met:
   1. Joints have been filled as specified herein.
   2. Concrete has attained a compressive strength of at least 4,000 psi.

B. Protect new concrete from construction operations, mechanical disturbances, water flow, and soiling until open for traffic.

C. Erect and maintain suitable barriers to protect concrete from traffic or other detrimental trespass until pavement is opened to traffic.

D. Maintain watchmen after normal working hours for at least a 24-hour period to ensure barriers are not removed or destroyed, and that trespass and vandalism upon pavements do not occur.

E. Wherever it is necessary that traffic, including Contractor's vehicles and equipment, be carried from one side of pavement to the other, construct suitable bridges over pavement, and maintain them in good condition as long as they may be required.

F. Leaving gaps in pavement to facilitate movement of traffic will not be allowed, unless prior written permission is received from the Engineer.

G. Protect new concrete from dirt, asphalt, and other deleterious substances that may be tracked onto new pavement from construction activities.

H. Pavement damaged by traffic or damaged from any other cause, prior to acceptance, shall be repaired or replaced to conform to the requirements herein.

++END OF SECTION++

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SECTION 32 1723
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Traffic lines and markings.
   2. Legends.
   3. Paint.
   4. Glass beads.

B. Definitions:
   1. Standard Specifications: State of New York, Department of Transportation (NYSDOT) Standard Specifications.

1.2 REFERENCE STANDARDS

A. The following is a list of standards which may be referenced in this Section:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M237, Standard Specification for Epoxy Resin Adhesives for Bonding Traffic Markers to Hardened Portland Cement and Asphalt Concrete.
      b. M247, Standard Specification for Glass Beads Used in Traffic Paint.
      c. M248, Standard Specification for Ready-Mixed White and Yellow Traffic Paints.
      d. M249, Standard Specification for White and Yellow Reflective Thermoplastic Striping Material (Solid Form).
   2. ASTM International (ASTM):
      a. D4280, Standard Specification for Extended Life, Nonplowable, Prismatic, Raised Retroflective Pavement Markers.
   3. Federal Specifications (FS):
      a. A-A-2886A, Paint, Traffic, Solvent-Based.
      b. TT-B-1325C, Beads (Glass Spheres); Retroflective.

1.3 SUBMITTALS

A. Action submittals:
   1. Product Data for each product or material incorporated into the Work:
      a. Paint.
      b. Thermoplastic material.

c. Reflective markers
d. Epoxies, resins, and primers.
e. Glass beads: proposed gradation.

2. Manufacturer Instructions:
   a. Application temperatures, eradication requirements, application rate, line thickness, type of glass beads, and bead embedment and application rate.
   b. Installation requirements, including storage and handling procedures.
3. Qualifications Statements:
   a. Qualifications for manufacturer and applicator.
   b. Manufacturer's approval of applicator.

1.4 QUALITY ASSURANCE

A. The pavement marking Manufacturer shall have been in the active manufacture of specified products for at least three years.

B. Applicator:
   1. The Applicator shall be an individual or firm specializing in the proper installation of the pavement marking specified herein.
   2. The Applicator shall have a minimum of three years of experience in applying the pavement markings specified and shall be certified and approved by the Manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Storage:
   1. Store in accordance with the Manufacturer’s instructions.
   2. Paint:
      a. Invert containers several days prior to use if paint has been stored more than two months.
      b. Minimize exposure to air when transferring paint.
      c. Seal drums and tanks when not in use.
   3. Protection:
      a. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
      b. Provide additional protection according to manufacturer instructions.

PART 2 PRODUCTS

2.1 GENERAL

A. All products shall be in accordance with Section 640 and Section 727 of the NYSDOT Standard Specifications.

2.2 PAINT

A. Color: white, yellow, or blue.

B. Traffic paint shall comply with Section 640-2 and Section 727-03 of the NYSDOT Standard Specifications.

C. Paint shall be homogeneous, easily stirred to smooth consistency, with no hard settlement or other objectionable characteristics during a storage period of 6 months.

2.3 THERMOPLASTIC MARKING

A. Color: white, yellow, or blue.

B. Thermoplastic markings shall be in accordance with Section 727-01 of the NYSDOT Standard Specifications.

2.4 GLASS BEADS

A. Glass beads shall comply with Section 727-05 of the NYSDOT Standard Specifications.

PART 3 EXECUTION

3.1 GENERAL

A. Surface Preparation, Application, and Protection: Comply with Section 635, Section 640, and Section 687 of the NYSDOT Standard Specifications.

3.2 APPLICATION

A. Do not apply materials if surface and ambient temperatures are outside temperature ranges required by pavement marking Manufacturer.

B. Do not apply exterior coatings during rain or snow if relative humidity is outside range required by Manufacturer, or if moisture content of surfaces exceeds that required by Manufacturer.

C. Minimum Conditions: Do not apply paint if temperatures are expected to fall below 55 degrees F within 24 hours after application.

D. Thermoplastic Compound: Do not apply unless pavement surface temperature is minimum 55 degrees F and rising.

E. Maximum VOCs: Do not exceed limit required by State or Environmental Protection Agency.

3.3 FIELD QUALITY CONTROL

A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

B. Acceptance:
   1. Repair lines and markings which, after application and curing, do not meet following criteria:
      a. Incorrect location.
      b. Insufficient thickness, width, coverage, or retention.
      c. Uncured or discolored material.
      d. Insufficient bonding.

3.4 CLEANING

A. Collect and lawfully dispose of residues from painting operations.

3.5 PROTECTION

A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free.

B. Follow Manufacturer instructions or use minimum of 30 minutes of dry time.

++END OF SECTION++

SECTION 32 1726
TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Tactile warning surfacing and accessories.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's information including characteristics, dimensions, domes, and special shapes.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

1.3 QUALITY ASSURANCE

A. Perform Work according to New York State Department of Transportation and ADA standards.

B. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years of experience.

C. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and protect materials according to manufacturer's instructions.

1.5 WARRANTY

A. Furnish five-year manufacturer's warranty for tactile warning surfacing.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING

A. Manufacturer:
   1. ADA Solutions, Inc.

2. Or approved equal.

B. Description:
   1. ADA-compliant tactile warning surfaces for visually impaired pedestrians.
   2. Suitable for installation on both asphalt and concrete.

C. Design and performance criteria:
   1. Loading: Single-wheel HS20-44, according to AASHTO HB-17.
   2. Resistant to impacts, wear, freeze-thaw, UV exposure, and stains.

D. Slip resistance:
   1. Comply with ASTM C1028.
   2. Wheelchair safety: Furnish minimum 41, 90-degree raised points per square inch.

E. Domes:
   1. Spacing: 2.4 inches, on-center.
   2. Size: 0.90-inch base bottom diameter, 0.45-inch top diameter, 0.20 inches high.

F. Cast-in-place type:
   1. Cast Iron.
   2. Width: Full width of ramp.
   3. Depth: 24 inches in direction of pedestrian travel.
   4. Color: Natural Patina.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate is level or to correct grade, is smooth, is capable of supporting tactile warning surface units and imposed loads, and is otherwise ready to receive Work of this Section.

3.2 PREPARATION

A. Surface preparation:
   1. Clean and dry paved surface prior to installing tactile warning surface modules.
   2. Blow or sweep surface free of dirt, debris, oil, grease, or gasoline.

3.3 INSTALLATION

A. Install tactile warning surfacing according to manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

A. Inspect for correct location, extent of coverage, and final grade.

3.5 CLEANING

A. Clean tactile warning surfacing according to manufacturer's instructions.

3.6 PROTECTION

A. Protect tactile warning surfacing from vehicular and pedestrian traffic on newly installed tactile warning surface modules for period of time as instructed by manufacturer.

3.7 MAINTENANCE

A. Furnish service and maintenance of tactile warning surfacing for three years from date of Substantial Completion.

++END OF SECTION++

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SECTION 32 2802
WATER DISTRIBUTION

PART 1 GENERAL

1.1 Applicable provisions of the Conditions of the Contract and Division #1, General Requirements, govern work in this Section.

1.2 DESCRIPTION OF WORK

A. The work of this Section consists of the provision of all materials, labor and equipment and the like necessary and/or required for the complete execution of domestic water distribution work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:

1. Connect to existing water service in field.
2. New Curb Stop Valve.
3. Wet tap.
4. Trenching and backfill as specified in Sections 31 2316.13 and 31 2323.
5. Water piping
6. PVC Sleeves
7. Disinfection of all new water piping
8. Test all systems and make operative.
9. "As built" drawings.

NOTES:

- Water work generally includes all piping, structures, fittings, thrust blocks and rodding, excavation and bedding, flushing, testing and disinfecting of all lines.
- In all piping installations, provide a filter fabric separation between pipe envelope material and balance of trench backfill. Fabric shall cover entire trench and be pinned to sides to prevent contamination of envelop material.

1.3 RELATED WORK SPECIFIED ELSEWHERE - Entire Project Specification with specific reference to those sections noted above and as follows:

A. Site Preparation and Protection
B. Earthwork, Compacted Fills
C. Trench Excavation and Backfill Systems
D. Pavements and Surfacing
E. Restoration

1.4 QUALITY ASSURANCE

A. Requirements given herein may be affected by other related requirements of the project specifications. Correlation of the contract requirements is the responsibility of the Contractor.

B. Requirements of Regulatory Agencies
   1. Comply with all municipal, state and federal laws, ordinances, rules, orders and regulations pertaining to the work, including any and all waivers issued to date. Contractor shall furnish all bonds necessary to get permit for cuts and connections to water services.

   2. Comply with applicable requirements of American National Standards Institute (ANSI) Standard A10.6-1969, Safety Requirements for Demolition.

C. The Contractor shall notify UDig NY or ONE-CALL at New York State – 1-800-962-7962 at least 72 hours before digging, trenching, blasting, demolishing, boring, backfilling, grading, landscaping or other earth moving operations of any public ways, rights of way and easements.

D. Comply with the provisions of the Manual of Accident Prevention in Construction of the Associated General Contractors of America, Inc., and the requirements of the Occupational Safety and Health Administration, United States Department of Labor.

E. All protection work and general operations shall be governed by the requirements of OSHA, as most recently amended.

F. The term "Local Standards" as used herein, means the standards of design and construction of the respective municipal department or utility company. Said standards apply except where exceeded by this specification.

G. Maintain in operating condition all active utilities, sewers, gutters and other drains encountered in the utility installation. Repair to the satisfaction of the Architect and the Owner of the improvement any surface or subsurface improvement damaged during the course of the work (unless such improvement is shown to be abandoned or removed), whether or not such improvement is shown on the Drawings.

H. Governing and/or Agency Standards
   1. American Society for Testing Materials (ASTM)
   2. American Association of State Highway and Transportation Officials (AASHTO)
   3. American Standards Association (ANSI)
   4. American Water Works Association (AWWA)
   5. New York State Department of Transportation, Office of Engineering, Standard Specifications, Construction and Materials dated May 4, 2006 with all amendments thereto. All payments shall be on a "Lump Sum" basis unless otherwise directed on the drawings or within these project specific specifications.
   6. Health Department of Putnam County)
   7. Local Jurisdiction applicable standards for water supply and distribution.

1.5 SUBMITTALS

- Submittals shall be made in groupings where installations are complementary, i.e. steel, steel decking, steel stairs, stair railings; roof systems/flashings; mechanical and electrical apparatus and the like. Failure to comply with this requirement will be cause for rejection of any or all submittals.
- Prepare and submit a fully developed submittal schedule
- These drawings are critical to the proper execution of the Work and failure to honor them may become the basis for denial of any and all claims for either or both "time" and "money".
- The Contractor is encouraged to submit for approval products made from recycled and/or environmentally responsible material. Every effort will be made by the Design Professional Team to approve these materials; the substitution request procedure shall still be enforced.

A. Certification of specification compliance.
B. Manufacturers Material Safety Data Sheet (MSDS) must be submitted for each manufactured product.
C. Product Data: Provide Architect with data on pipe materials, pipe fittings, hydrants, valves, structures and accessories.

1.6 CONFERENCE

A. Before any work is started, a conference shall be held between the Contractor and the Owner concerning the work under this Contract.

1.7 EXISTING PLANTS AND SITE CONDITIONS

A. The Contractor shall take necessary precautions to protect existing site conditions. Should damage be incurred, the Contractor shall repair the damage to its original condition at his own expense.

1.8 "AS BUILT" DRAWINGS

A. Show deviations from the bid documents made during construction affecting the main line pipe, controller locations, remote control valves, quick-coupling valves and all sprinkler heads. The drawing shall also indicate and show approved substitutions of size, material and manufacturer's name and catalog name and catalog number. The drawings shall be delivered to the Owner before final acceptance of work.

1.9 SUSTAINABILITY

A. In the selection of the products and materials of this section as well as for the entire project, preference will be given to those with the following characteristics:
   1. Water based.
   2. Water-soluble.
   3. Can be cleaned up with water.
   4. Non-flammable.

5. Biodegradable.
6. Low or preferably no Volatile Organic Compound (VOC) content.
7. Manufactured without compounds that contribute to ozone depletion in the upper atmosphere.
8. Manufactured without compounds that contribute to smog in the lower atmosphere.
9. Do not contain methylene-chloride.
10. Do not contain chlorinated hydrocarbons.
11. Contains the least possible of post-consumer or post-industrial waste.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials shall be governed by the applicable portions of the REFERENCE STANDARDS set forth in Part 1 above or as maybe modified herein.
   1. Provide proper fittings, except as otherwise shown or specified, at major changes in direction and at branch connections.

2.2 PLASTIC PIPING

A. All main line pipe shall be Class 200; Type 1120-1220 polyvinyl chloride (PVC) pipe and shall conform to CS-256-63.

2.3 PLASTIC FITTINGS

A. Plastic fittings shall be Class 200, polyvinyl chloride (PVC) standard weight as manufactured by Spears, Dura, or approved equal. Only solvent weld or insert fittings are acceptable; no saddle type clamping of fittings will be used.

2.4 SOLVENT CEMENT

A. Compatible with PVC pipe and of proper consistency.
B. ISOLATION VALVES
C. Three inch and smaller isolation valves shall be screwed bonnet, bronze body, solid-wedge type gate valves with threaded ends, non-rising stems, and shall be rated for a normal operating pressure (cold water) of at least 200 PSI. They shall be Kitz code 27.

2.5 VALVE BOXES

A. Access to all remote control and main line isolation valves shall be provided by Ametek standard rectangular boxes. The valve boxes shall be 12" standard rectangular (#170101) with green cover (#173134), as manufactured by Ametek, Plymouth Products Division, Sheboygan, Wisconsin.

2.6 BEDDING AND BACKFILL MATERIALS - See Section 31 2323.

Balance of materials shall be as specified elsewhere in this Section.

PART 3 EXECUTION

3.1 INSPECTION AND ACCEPTANCE

A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation. Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.

B. Contractor shall acquaint himself with all site conditions. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown in plans.

C. Failure to do so will make Contractor liable make necessary adjustments in the layout as may be required to connect to existing water supply line inside building.

3.2 CONSTRUCTION

A. Excavating and trenching shall conform to their specific sections.

B. Restore all surfaces, patch all walls, existing underground installations, etc. damaged or cut as a result of the excavations to their original condition and in a manner approved by the Owner.

C. Trenches shall be made wide enough to allow a minimum of 2 inches between parallel pipe lines. Trenches for pipe lines shall be made of sufficient depths to provide minimum cover from finish grade as follows:

D. 48” cover over all water lines

E. Maintain all warning signs, shoring, barricades, flares and red lanterns as required by the Safety Orders of the Division of Industrial Safety and any local ordinances.

3.3 RESTRAINTS, SUPPORTS AND THRUST BLOCKS

A. Install restrained joints at all plugs, caps, tees, bends and other fittings in pressure piping as recommended by the manufacturer. Assembly of restrained joints shall be in strict accordance with manufacturer’s recommendations.

B. Provide concrete and metal cradles, collars and block.

C. Thrust Blocks

1. All plugs, caps, tees, bends and other fittings in pressure piping systems shall be provided with concrete thrust blocking to resist test pressures unless otherwise shown on the drawings.
2. Concrete thrust blocks and tie rods shall conform to the details shown on the drawings.
3. All concrete to be 3000 psi and shall be placed around the fittings to completely fill the space between the fittings and the undisturbed walls of the trench. Concrete shall not overlap any joint and shall be placed so as not to interfere with removing or installing any of the jointing hardware.

3.4 PIPE LINE ASSEMBLY

A. Install remote control valves where shown and group together where practical. Place no closer than 6 inches to walk edges, buildings, and walls.

B. Plastic pipe and fittings shall be solvent welded using solvents and methods as recommended by manufacturer of the pipe, except where screwed connections are required. Pipe and fitting shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with non-synthetic bristle brush.
C. Pipe may be assembled and welded on the surface. Snake pipe from side to side of trench bottom to allow for expansion and contraction.
D. Make all connections between plastic pipe and metal valves or steel pipe with threaded fittings using plastic male adapters.

3.5 CLOSING PIPE AND FLUSHING LINES

A. Cap or plug all openings as lines have been installed to prevent the entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
B. Thoroughly flush out all water lines before installing heads, valves and other hydrants.
C. Test in accordance with paragraph on Hydrostatic Tests.
D. Upon completion of the testing, the Contractor shall complete drip assembly and adjust for proper distribution.

3.6 HYDROSTATIC TESTS

A. Request the presence of the Owner or Consultant in writing at least 48 hours in advance of testing.
B. Testing to be accomplished at the expense of the Contractor and in the presence of the Owner.
C. Center load piping with small amount of backfill to prevent arching or slipping under pressure.
D. Apply a continuous and static water pressure of 60 PSI when welded plastic joints have cured at least 24 hours and with the risers capped as follows:
E. Main lines and sub mains to be tested for 1 hour.
F. Lateral lines to be tested for 1 hour.
G. Repair leaks resulting from tests.

3.7 BACKFILL AND COMPACTING (Coordinate with Section for trenching and backfill)

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of rubbish.
B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 90% density in turf areas, 95 % in paved areas
C. Dress off all areas to finish grades.

3.8 CLEAN-UP

A. Remove from the site all debris resulting from work of this section. Job site must be left clean and repaired as per Contract and Owner's approval.

3.9 DISINFECTING OF POTABLE WATER MAINS

A. Disinfecting shall conform to AWWA C601 except that the placement of chlorine powder or tablets inside the pipe during the installation shall not be allowed. Disinfect water main after the piping has passed the pressure and leakage tests.
B. Prior to disinfecting, the piping shall be flushed with water at a minimum velocity of 2.5 fps.
C. Disinfecting shall be accomplished by applying a chlorine solution with a concentration between 50 ppm and 100 ppm. The chlorine solution shall remain in the piping for a minimum of 24 hours. The concentration at the end of this period shall be at least 25 ppm in all sections of the main. If the residual is less than 25 ppm, the entire procedure shall be repeated.
D. While the chlorinated water is being added, all appurtenance (valves, hydrants, etc.) shall be operated so as to completely disinfect the new work.
E. During the application of the chlorine, valves shall be positioned so that the chlorine solution in the section being disinfected will not flow into water mains in active service.
F. Chlorine residual samples shall be taken as directed by the Owner's Representative.
G. After the 24 hour retention period, the heavily chlorinated water shall be flushed from the main until the residual testing indicates that the chlorine concentration is approximately that of the neighboring service area.
H. The contractor shall dispose of the heavily chlorinated water into a sanitary sewer or tank truck.
I. In no instance shall this water be emptied onto roadways or into ditches, culverts, streams or wetlands.
J. After disinfecting and final flushing and prior to placing the lines in service, contractor shall take bacteriological samples. The number of samples and their collection point shall be as directed by the Owner's Representative and local authorities having jurisdiction.
K. The testing laboratory performing the bacteriological analysis shall be acceptable to the Owner's Representative.
L. Contractor shall submit three (3) copies of the laboratory analysis to the Owner's Representative.
M. Should safe results not occur after laboratory tests, contractor shall at his expense repeat the disinfecting procedure until safe results are obtained.
N. All precautions shall be taken to maintain dry and sanitary conditions and to prevent contamination of any piping at the contractor's expense.
O. If, in the opinion of the Owner's Representative, contamination has occurred, the contractor shall repeat the disinfecting testing at his cost and expense.

3.10 WATER FOR TESTING

A. Water for flushing, testing and disinfection may be obtained from the school system.
A. Furnish all means and apparatus for getting the water into the pipelines.
B. Furnish, install, and remove any additional temporary blow off piping required to

discharge water used for flushing, testing and disinfecting.

3.11 NOTICE

A. The Contractor shall give the Owners Representative reasonable notice as to the time when he will be prepared to test portions of the work.

3.12 WASTE MANAGEMENT

A. Separate and recycle materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.
B. Set aside and protect materials suitable for reuse and/or remanufacturing.
C. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

++END OF SECTION++

SECTION 32 3113
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes all performance and material requirements for temporary construction and permanent chain-link fences and gates as shown on the Drawings.

B. Scope of the work includes:
1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts.
4. Manual gates and related hardware.

C. Related work specified elsewhere:
1. Section 31 1000, Site Clearing.
2. Section 31 2213, Subgrade Preparation.

1.2 REFERENCE STANDARDS

A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
   a. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
   b. A123. Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   c. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   d. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   e. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
   f. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   g. A817, Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
   h. A824, Specification for Metallic-Coated Steel Marcelled Tension Wire for use with Chain Link Fence.
   i. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

j. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
k. C94, Standard Specification for Ready-Mixed Concrete.
l. F552, Standard Terminology relating to Chain Link Fencing.
m. F567, Standard Practice for Installation of Chain-Link Fence.
n. F626, Standard Specification for Fence Fittings.
o. F668, Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
p. F900, Standard Specification for Industrial and Commercial Swing Gates.
q. F934, Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
r. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
s. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
t. F1183, Standard Specification for Aluminum Alloy Chain Link Fence Fabric.
u. F1184, Standard Specification for Industrial and Commercial Horizontal Slide Gates.
v. F1345, Standard Specification for Zinc - 5% Aluminum - Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric.
w. F1664, Standard Specification for Poly(Vinyl Chloride)(PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
x. F1665, Standard Specification for Poly(Vinyl Chloride)(PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used with Chain-Link Fence.
y. F1910, Standard Specification for Long Barbed Tape Obstacles.
z. F1911, Standard Practice for Installation of Barbed Tape.
aa. ASTM F2781, Standard Practice for Testing Forced Entry, Ballastic, and Low-Impact Resistance of Security Fence Systems.

2. Chain Link Fence Manufacturers Institute (CLFMI):
   a. SFR 2445. Security Fence Recommendations.
   b. CLF TPO211, Tested and Proven Performance of Security Grade Chain Link Fence Systems.
   c. WLG2445, Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing.
3. Institute of Electrical and Electronic Engineers, Inc. (IEEE):
   a. C2, National Electric Safety Code.
4. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 volts maximum).

5. State of New York Department of Transportation (NYSDOT), Standard Specifications.
6. Underwriters' Laboratories, Inc. (UL):
   a. 325, Door, Drapery, Gate, Louver and Window Operators.
   b. 467, Standard for Safety Grounding and Bonding Equipment.

1.3 SUBMITTALS

A. Action submittals:
   1. Shop drawings:
      a. Indicate site plan layout of fence locations with dimensions, locations of gates and opening sizes, cleared area, elevation of fence and gates, and details of attachments and footings.
      b. Product data: Submit data on fabric, posts, accessories, fittings and hardware to demonstrate material compliance with this section.
   2. Certifications:
      a. Manufacturer's material certifications, certifying compliance with this specification and referenced ASTM specifications.

B. Informational submittals:
   1. Manufacturer's installation instructions:
      a. Submit installation requirements, post foundation and anchor bolt template.
      b. Manufacturer's Certificate of Conformance: Certify that materials and coatings furnished have been tested and conform to the referenced ASTM Specification.

C. Closeout submittals:
   1. Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum of five (5) years of experience.

B. Fence Contractor: Company with demonstrated successful experience installing similar projects and products in accordance with ASTM F567 and have at least five (5) years of experience.

C. Tolerances: Current published edition of ASTM specifications tolerances shall apply. ASTM specification tolerances supersede any conflicting tolerance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials and components: Conform to CLFMI Product Manual.

B. All carbon steel materials, components, and accessories shall be hot-dip galvanized after fabrication.

2.2 CHAIN LINK FABRIC

A. Steel chain link fabric:
   1. 2-inch mesh, 9- gauge galvanized steel wire weave. Specified gauge shall be the gauge thickness of the steel wire, exclusive of coatings.
   2. Height: as shown on the Drawings.
   3. Top selvage: knuckled
   4. Bottom selvage: knuckled
   5. Material:
      a. Fabric shall be a zinc-coated steel wire fabric, hot dip galvanized in accordance with ASTM A392.
      b. Minimum zinc coating: 2 oz / sq ft.

2.3 STEEL FENCE FRAMEWORK

A. Round steel pipe and rail:
   1. Conform to ASTM F1043, Group IA Heavy Industrial Fence Framework, Schedule 40 galvanized pipe, per ASTM A1083.
   2. Yield strength: 30 ksi.
   3. Exterior hot-dip zinc coating minimum average: 2.0 oz / sq ft.
   4. Line Posts: 2-inch Schedule 40 steel pipe, per ANSI B36.10.
   5. End, corner, pull posts: 2 inch Schedule 80 steel pipe, per ANSI B36.10.
   6. Top, brace, bottom and intermediate rails: 1-1/4-inch Schedule 40 steel pipe, per ANSI B36.10.

B. All posts shall be equipped with pressed steel combination tops. Tops shall be provided with a hole to permit through passage of the top rail.

C. Gate Frame:
1. 1-7/8 inch diameter for welded or fittings and truss rod fabrication.
2. When fittings are used, 3/8-inch minimum diameter truss rods shall be provided to prevent sag or twist.

D. Tension wire:
1. Metallic coated steel marcelled tension wire: 7 gauge marcelled wire, conforming to ASTM A824.
2. Galvanizing: 2.0 oz / sq ft.

E. Tension bars:
1. Tension bars shall be minimum 3/16-inch by 3/4-inch flat steel plates and no more than 2 inches shorter than the fabric height.
2. Bars shall be hot-dip galvanized.

F. Tension bands: Tension bands shall be formed from No. 12 gauge flat or beveled steel and attached with 3/8-inch diameter carriage bolts hot-dip galvanized.

G. Tie wire: Aluminum alloy steel wire.

H. Barbed wire: Barbed wire shall consist of two (2) strands of twisted 12-1/2 gauge steel wire with 4 point 14 gauge barbs on 4-inch spacing; wire shall be zinc coated.

2.4 FITTINGS

A. Tension and brace bands:
1. Galvanized pressed steel conforming to ASTM F626, minimum steel thickness of 12 gauge, minimum width 3/4-inch and minimum zinc coating of 0.2 oz / sq ft.
2. Supply bands with 3/8-inch galvanized steel carriage bolts.

B. Terminal post caps, line post loop tops, rail and brace ends Boulevard clamps, and rail sleeves: Conforming to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.2 oz / sq ft.

C. Truss rod assembly: Conforming to ASTM F626, 3/8-inch diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz / sq ft, assembly capable of withstanding a tension of 2,000 lbs.

D. Tension bars:
1. Conforming to ASTM F626.

2. Galvanized steel one-piece length 2 inches less than the fabric height.
3. Minimum zinc coating: 1.2 oz / sq ft.
4. Bars for 2-inch mesh shall have a minimum cross-section of 3/16 inch by 3/4 inches.

E. Barbed wire arms:
1. Conforming to ASTM F626, pressed steel, hot-dip galvanized after fabrication, minimum zinc coating 1.2 oz / sq ft., capable of supporting a vertical load of 250 lbs.
2. Type I: Three strand, 45-degree arm.
3. Type II: Three strand, vertical arm.
4. Type III: V-shaped, six strand arm.

2.5 TIE WIRE AND HOG RINGS

A. General:
1. Conforming to ASTM F626.
2. Minimum wire thickness: 9 gauge galvanized steel.
3. Minimum zinc coating: 1.2 oz/ sq. ft.

2.6 SWING GATES

A. Size and configuration: as shown on the Drawings.

B. General:
1. Galvanized steel welded fabrication conforming to ASTM F900.
2. Gate frame members shall be minimum 2-inch Schedule 40 steel pipe.
3. Frame members shall be spaced no greater than 8 feet apart vertically and horizontally.
4. Welded joints shall be protected by applying zinc-rich pain in accordance with ASTM A780.
5. Positive locking gate latch shall be fabricated of 5/16-inch thick by 1-3/4 inch pressed steel, galvanized after fabrication.
6. Steel post and frame hinges shall be galvanized malleable iron or heavy gauge pressed steel.
7. Match gate fabric to that of the fence system.
8. Gate post size: 2-inch Schedule 80 galvanized steel pipe posts.

2.7 HORIZONTAL SLIDE GATES

A. Cantilever slide gates: Conforming to ASTM F1184, Type II.

B. General:
1. Class 1, External roller design: Horizontal top and bottom steel pipe “track” members shall be 2-inch Schedule 40 steel pipe, vertical and internal members 1-1/2 Schedule 40 steel pipe.

2. Gate frame shall be fabricated by welding, vertical and horizontal members located no greater than 8 feet apart.
3. The length of back frame support sections shall be a minimum of 40% of the opening.
4. Welded joints shall be protected by applying zinc-rich paint in accordance with ASTM A780 shall be designed to open and close with an initial force no greater than 40 lbs.
5. Match chain link fabric with the adjacent fence system.
6. Positive locking latch shall be fabricated of galvanized pressed steel.
7. Furnish steel drop bars with double gates.
8. Gateposts: 4 inch Schedule 40 steel pipe.
9. Provide safety protective guards for the top and bottom external rollers.

2.8 FENCE GROUNDING

A. Conductors:
   1. Bare, solid wire for No. 6 AWG and smaller, stranded wire for No 4 AWG and larger.
   2. Material, above and below ground: copper.
   3. Bonding jumpers: braided copper tape, 1-inch wide, woven No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.
   1. Connectors for below-grade use: exothermic welded type.
   2. Grounding rods: Copper-clad steel.

2.9 CONCRETE

A. Concrete for foundations shall conform to the following:
   1. Minimum 28-day compressive strength: 3,000 psi.
   2. Portland cement: Type I, in accordance with ASTM C150.
   3. Course and fine aggregates: Comply with ASTM C33.
   4. Air entrainment: 4% to 7%, by admixture only.
   5. Maximum slump: 4 inches.
   6. Maximum water-cement ratio: 0.46.
   7. Ready mix concrete from an established company may be acceptable if it conforms to ASTM C94 and this Specification.

PART 3 EXECUTION

3.1 CLEARING FENCE LINE

A. Comply with Section 31 1000, Site Clearing.

B. Layout:
   1. Comply with Section 01 7123, Field Engineering.
   2. Provide all surveying control for establishing fence lines.
   3. Clear and grub fence lines to sufficient width to install chain link fences, as shown on the Drawings.

C. Drainage crossings: Where the chain link fence must cross drainage ditches or swales, the main fence shall be carried across a ditch or swale with additional fence fabric added below.

3.2 FRAMEWORK ERECTION

A. Posts:
   1. Set posts plumb in concrete footings in accordance with ASTM F567.
   2. Minimum footing depth: 3'-0", plus an additional 3 inches for each foot of fence height over 4 feet.
   3. Minimum footing diameter shall be at 12 inches.
   4. Top of post concrete footing shall be at grade, crowned to shed water away from the post.
   5. Install line posts at intervals not exceeding 10 feet on-center.

B. Top rail:
   1. Install 21-foot lengths of rail continuous through the line post or barb arm loop top.
   2. Splice rail using top rail sleeves, minimum 6 inches long.
   3. Secure rail to terminal post with a brace band and rail end.
   4. Field-cut bottom rail or intermediate rail and secure to line posts using boulevard bands or ends and brace bands.

C. Terminal posts:
   1. End, corner, pull, and gate posts shall be braced and trussed for fence feet and taller, and for fences 5 feet in height not having a top rail.
   2. The horizontal brace and diagonal truss rod shall be installed in accordance with ASTM F567.

D. Tension wire:
   1. Install 4 inches up from the bottom of the fabric.
   2. Fences without a top rail shall have a tension wire installed 4 inches down from the top of the fabric.
   3. Tension wire shall be stretched taut, independently and prior to the fabric, between the terminal posts and secured to the terminal post using a brace band.
   4. Secure the tension wire to the chain link fabric with 9-gauge hog rings, 18 inches on-center and to each line post with a tie wire.

3.3 CHAIN LINK FABRIC INSTALLATION

A. Fabric installation:
   1. Install fabric to inside of the framework.
   2. Attach fabric to the terminal post by threading the tension bar through the fabric.
   3. Secure the tension bar to the terminal post with tension bands at 5/16-inch carriage bolts spaced no greater than 12 inches on-center.
   4. Small-mesh fabric less than 1 inch: attach to terminal post by sandwiching the mesh between the post and a vertical 2-inch wide by 3/16-inch steel bar using carriage bolts, through-bolted through the bar, mesh and post spaced 15 inches on-center.
   5. Stretch chain link fabric taut and free of sag.
   6. Secure fabric to the line post with tie wires spaced no greater than 12 inches on center and to rails spaced no greater than 18 inches on center.
   7. Secure the fabric to the tension wire with hog rings spaced no greater than 18 inches apart.
   8. Pre-formed 9-gauge galvanized steel power-fastened tie wire shall be wrapped 360 degrees around the post or rail and fabric picket, twist the two wire ends together three full turns per ASTM F567.
   9. Excess wire shall be cut off and bent over to prevent injury.
   10. Installed fabric shall have a ground clearance of no more than 2 inches.

3.4 BARBED WIRE INSTALLATION

A. Barbed wire:
   1. Stretched taut between terminal posts and secured in the slots provided on the line post barb arms.
   2. Attach each strand of barbed wire to the terminal post using a brace band.

3.5 GATE INSTALLATION

A. Swing gates:
   1. Install swing gates and gate posts in accordance with ASTM F567.
   2. Direction of swing shall be as shown on the Drawings.
   3. Gates shall be plumb in the closed position have a bottom clearance of 3 inches.
   4. Hinge and latch offset opening space from the gate frame to the post shall be no greater than 3 inches in the closed position.
   5. Double-gate drop bar receivers shall be set in concrete footings a minimum of 6 inches in diameter and 2 feet deep.
   6. Install gate leaf holdbacks for all double-leaf gates.

B. Horizontal slide gates:
   1. Install in accordance with manufacturer's instructions and in accordance with ASTM F567.
   2. Gates shall be plumb in the closed position, installed to slide with an internal pull force no greater than 40 lbs.
   3. Double gate drop bar receivers shall be installed in a concrete footing a minimum of 6 inches diameter and 2 feet deep.
   4. Roller guards and guide posts shall be installed on Type I external roller cantilever slide gate in accordance with ASTM F1184.
   5. Ground clearance shall be 3 inches, minimum.

3.6 BARBED TAPE INSTALLATION

A. Barbed tape: Barbed tape when specified shall be installed in accordance with ASTM F1911.

3.7 NUTS AND BOLTS

A. Bolts:
   1. Carriage bolts for fittings shall be installed with the head on the secure side of the fence.
   2. Peen all bolts over after assembly to prevent removal of the nut.

3.8 ELECTRICAL GROUNDING

A. Ground fences at a maximum interval of 1,000 feet in accordance with the IEEE C2, National Electric Safety Code.

B. Protection at crossings of overhead electrical power lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of the crossing.

C. Grounding method: At each grounding location, drive a 10-foot grounding rod vertically until top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.

3.9 FIELD QUALITY CONTROL

A. Post and fabric testing: Test fabric tension and line post rigidity in accordance with ASTM F1916.

B. Gate tests:
   1. Prior to acceptance of installed gates, demonstrate proper operation of gates under each possible open and close condition specified.

2. Adjust gate to operate smoothly, easily, and quietly, free of binding, war, excessive deflection, distortion, non-alignment, misplacement, disruption, or malfunction, throughout the entire operational range.
3. Confirm latches and locks engage accurately and securely without forcing and binding.

3.10 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at the Site to train Owner's personnel in proper adjustment, operation, and maintenance of gates.

3.11 CLEANING

A. The area of the fence line shall be left neat and free of any debris caused by the fence installation.

++END OF SECTION++

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SECTION 32 9210
RESTORATION OF TURF AREAS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The contractor shall supply all materials, equipment, labor, incidentals and maintenance required in order to provide an acceptable stand of turf by topsoiling and seeding of all disturbed areas including stripping topsoil, grading, placing topsoil, fertilizing and seeding, in accordance with the drawings and as specified.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be stockpiled for reuse in landscape work. If quality and/or quantity of stockpiled topsoil is insufficient, provide additional topsoil as specified to complete landscape work. Remove and dispose of off-site all excess topsoil.

B. Topsoil:

l. All topsoil shall be fertile, friable, natural topsoil without admixture of subsoil. All topsoil shall be screened to remove all extraneous matter. Screened topsoil shall conform to the mechanical analysis specified below and shall be free of stone two inches (2") in any dimension, lumps, plants or their roots, sticks and similar debris, or any other undesirable material.

2. Topsoil shall not be delivered or used in a frozen or muddy condition.

3. All topsoil to be furnished shall be subject to approval of the Owner's Representative.

4. Furnish a certified analysis, made by a recognized authority, of any topsoil furnished to complete the work of planting. Test reports shall match the format listed below.

5. Topsoil shall have an acidity range of pH 5.0 to pH 7.0 and shall contain not less than six percent (6%) organic matter as determined by loss on ignition of moisture-free samples dried at l00 degrees centigrade. The mechanical analysis of the soil shall be as follows:

Passing	Retained On	Percentage
l" screen		l00%
l" screen	1/4" screen (gravel)	Not more than 3%
l/4" screen	No. l00 USS mesh sieve (sand)	40% - 60%

No. l00 USS(Very fine sand, silt and clay) 40% - 60%

6. Topsoil in which more than sixty percent (60%) of the material passing the USS No. l00 mesh sieve consists of clay as determined by Pouyoucous hydrometer, or by the decantation method shall not be used. All percentages are to be based on dry weight samples. The chemical and mechanical analysis shall state the above items in correct quantities.
7. The Landscape Architect reserves the right to take samples of the topsoil from time to time whether delivered to or stored at the site. These samples will be analyzed for comparison with the Specifications. Should tests show that topsoil does not comply with the Specifications, the material may be rejected or such other remedy made as approved by the Owner's Representative in the form of humus or other fertilizers.

B. Fertilizer: Commercial fertilizer (14-28-15) shall have the following composition by weight: Nitrogen 14%; Phosphorous 28%; Potash 14%; as manufactured by Jonathan Green "New Seeding Lawn Fertilizer".

C. Seed Mixture: The seed used shall be fresh, recleaned seed of the latest crop containing a blend of those listed below and shall be harvested from one field to ensure a uniform color and texture. Percentages of each grass type are to be within the given range for that type.

20% Devine Perennial Ryegrass
20% America Kentucky Bluegrass
20% Apollo Kentucky Bluegrass
20% Limousine Kentucky Bluegrass
20% Midnight Kentucky Bluegrass

D. Mulch: Mulch shall be approved salt hay or weed free straw and stabilized with a binder.

PART 3 - CONSTRUCTION

3.1 STRIPPING SOIL

A. All topsoil shall be stripped as described and stockpiled for reuse. The quantity of topsoil to be removed shall be approved by the Engineer. If sufficient topsoil is not retained on-site, the contractor will be required to provide the difference from off-site sources at no expense to the owner. Quality of topsoil from off-site sources shall be subject to Engineer's approval.

3.2 GRADING AND SUBGRADE PREPARATION

A. Perform grading operations to bring subgrade to levels required and to contour indicated on the drawings.

B. Completed subgrade shall be approved by Engineer before topsoil and seeding.

C. The approved subgrade shall be scarified to a depth of 2 inches to permit mixing with rootzone material.

3.3 SEEDBED PREPARATION

A. Seasonal and weather limitations - All operations including seedbed preparation shall be performed only when the soil is in proper condition to permit satisfactory work. Continuation of work at other than specified times or conditions shall proceed only with consent of the Engineer.

B. Leveling - Any undulations or irregularities in the surface resulting from fertilization, tillage or any other causes shall be leveled prior to seeding. Flooded, washed out, or otherwise damaged areas shall be reconstructed and all grades reestablished in conformance with the drawings and specifications.

C. Cleanup - Prior to seeding, the surface shall be cleared of all trash, debris and stone larger than 1-1/2 diameter and of all roots, brush, wire, grade stakes and other objects that could be a hindrance to maintenance operations and use.

D. Fertilizing - After final seedbed preparation, apply fertilizer at the manufacturer's recommended rate indicated on the bag. Fertilizer shall be distributed evenly over all areas to be seeded by machine, or as otherwise approved by the Engineer, and shall be worked lightly into the top 1 inch of the rootzone mixture.

3.4 SEEDING

A. The contractor shall furnish and place all materials required for seeding in all topsoiled areas.

B. All areas to be seeded shall be thoroughly disked or otherwise loosened to a depth of 4 inches and shall be raked to true lines free from all unsightly variations, bumps, ridges, or depressions. All sticks, stones, roots or other objectionable material which might interfere with the formation of a finely pulverized seed bed shall be removed from the soil. Ground limestone and commercial fertilizer shall be applied as specified above.

C. The soil shall then be raked to a smooth, even draining surface and compacted with an approved roller as directed by the Engineer. Any depressions which occur shall be regraded and rerolled until a satisfactory grade is obtained.

D. The rate of seeding shall be 10 lbs. per 1000 sq. ft. of area. Grass seed shall be sown by approved machine in such manner that a uniform stand will result and as indicated on the drawings. After seeding, the surface shall be evenly raked with a fine toothed rake and rolled with an approved roller as directed by the Engineer.

E. Grass seed shall be sown preferably in the fall between August 25 and October 1, in the spring between March 15 and May 1, or at such other times as are approved by the

Engineer. All seeding is to be done in dry or moderately dry soil and at times when the wind does not exceed a velocity of 5 miles per hour.

3.5 MULCHING

A. All seeded areas shall be mulched not later than three (3) days following seeding. Ground surfaces shall be completely covered at a rate of at least two (2) tons per acre.

B. Mulch shall be anchored using jute or other approved netting properly fastened in place.

C. Subsequent watering - Seed shall be watered as required to maintain adequate moisture in the soil. In the absence of rainfall, seed shall be watered at frequencies dictated by need.

3.6 HYDROSEEDING

A. The contractor shall have the option of hydroseeding the lawn areas at no increased cost to the owner and subject to the written approval of the Engineer. If the contractor selects this option, he shall submit to the Engineer for approval a complete specification of the hydroseeding operation he intends to follow. Hydroseeding with a cellulose fiber mulch is acceptable.

3.7 MAINTENANCE, REPLACEMENT, GUARANTEE AND FINAL INSPECTION

A. Maintenance operations shall begin immediately after seeding and shall be continued as required until provisional acceptance. Grass shall be kept in a healthy, growing condition by mowing, watering, weeding, cultivating, disposal of waste vegetation, fertilizing, spraying or spreading of approved materials to prevent or treat infestations of insects or disease and all other operations required to maintain a strong, vigorous and healthy stand of grass.

B. Seeded areas shall be mowed to a height of 2 inches whenever the average height of grass is over 3 inches. When the amount of cut grass is heavy it shall be removed to prevent destruction of the underlying turf.

C. Seeded areas that are dead, or in the opinion of the Engineer, in an unhealthy, unsightly or badly impaired condition, shall be replaced by the contractor as soon as reasonably possible after the unsatisfactory condition has become evident. No replacement shall be made when weather or soil is unfavorable for seeding. Such replacements shall be made in the same manner as specified for the original seeding.

3.8 ACCEPTANCE

A. Inspection of the work of seeding to determine provisional acceptance will be made by the Engineer upon written notice requesting such inspection submitted by the contractor at least seven (7) days prior to the anticipated date of inspection. Request may be made subsequent to the second mowing of the turf.

B. After inspection the contractor will be notified in writing by the Engineer of provisional acceptance of all work, or if there are any deficiencies of the requirements for completion of the work.

C. All seeded areas shall be guaranteed for one (l) growing season commencing with the date of provisional acceptance.

D. Upon provisional acceptance, the owner will assume general responsibility for maintenance of the lawn areas. The contractor shall, however, make periodic visits to the site during the guarantee period to advise the owner of proper maintenance procedures.

E. Failure of the contractor to notify the Engineer, in writing, of inadequate maintenance by the owner of the lawn areas installed under this contract shall constitute acceptance of the owner's maintenance operations by the contractor. The contractor shall not therefore use the owner's alleged lack of proper maintenance as a basis for voiding his responsibilities under the guarantee herein specified.

F. At the expiration of the guarantee period, upon written request of the contractor, inspection for final acceptance will be made by the Engineer. All remedial work to seeding work by the contractor shall be completed prior to the request for final acceptance.

++END OF SECTION++

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SECTION 32 9238
SODDING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies material and performance requirements for turf and grasses, as shown on the Drawings and as otherwise called herein.
B. This Section includes the following:
   1. Site preparation.
   2. Imported topsoil.
   3. Sodding materials.
   4. Soil amendments.

1.02 SUBMITTALS

A. Comply with Section 01 33 00, Submittal Procedures.
B. Product Data: Common name of each grass species
C. Topsoil: Topsoil test results.
D. Soil amendments:
   1. Product certification signed by manufacturers certifying that their products comply with specified requirements.
   2. Manufacturer’s certified analysis for standard products.
E. Planting schedule indicating anticipated dates and locations.
F. Product data in the form of manufacturer's technical data, specifications, and installation instructions and accessories.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful grass establishment.
B. Topsoil Analysis: Furnish the topsoil analysis in accordance with Specification Section 32 93 00, Plants.
C. Soil Amendment: Prepare a soil amendment procedure that will adjust all of the topsoil to be used in construction lawns to a pH of 6.5 if the pH testing indicates a pH other than 6.5.
D. Sod:
   1. Grower’s Qualifications: Sod shall be commercially grown by a producer specializing in sod production and harvesting with a minimum 5 years’ experience.
   2. Certifications: Sod shall be accompanied by a certificate indicating compliance with the regulations of the New York State Department of Agriculture and Markets.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Tag sod with common name of each grass species.
B. Protect root systems from exposure to wind or sun.
C. Protect sod against dehydration, contamination, and heating during transportation and delivery.
D. Do not deliver more sod to the site than can be installed within 24 hours.
E. Store sod in a moistened condition under shade, or cover with wet burlap.
F. Deliver commercial fertilizer in standard size bags showing weight, analysis, and the name of the manufacturer.

1.05 COORDINATION AND SCHEDULING

A. Do not install sod when temperature is below 32 degrees F, or on saturated or frozen soil conditions.
B. Protect newly installed sod against foot and vehicular traffic.

PART 2 - PRODUCTS

2.01 SOD

A. Sod:
   1. Turf sod shall consist of a blend of Kentucky Bluegrass (60–70%) and Fine-Leaved Fescue (30–40%).
   2. Sod shall be dense, uniform in color, leaf texture, and growth habit, and free of diseases, injurious insects, and nematodes**.**
   3. Sod shall be suitable for athletic fields and tolerant of foot traffic and NY cool-season climate conditions**.**
B. Mowed Height When Harvested: 1½–2 inches.
C. Thatch: Maximum ½ inch.
D. Weeds:
   1. Sod shall be free of Bermuda grass, quack grass, Johnson grass, poison ivy, nut sedge, nimblewill, Canada thistle, bindweed, wild garlic, and perennial sorrel.
   2. Sod may contain incidental bent grass, ground ivy, or brome grass not exceeding 1% of total area**.**
   3. Sod may contain fewer than 5 plants per 100 sq ft of common annual weeds such as jimson weed, mustard, lamb's quarter, chickweed, cress, or crabgrass.
E. Disease Resistance: Sod shall be resistant to common turf diseases for the region, including stripe rust, leaf spot, and dollar spot.

2.02 TOPSOIL

A. Topsoil:
   1. Shall comply with ASTM D5268.

2. pH range: 5.5–7.5.
3. Organic matter content: 5–10%.
4. Free of stones larger than ¾ inch, roots, sod, clay lumps, and other materials harmful to plant growth.

B. Depth: Sod shall be placed on screened topsoil of minimum 4 inches rolled depth.

2.03 SOIL AMENDMENTS

A. Lime:
1. ASTM C602, Class T, agricultural limestone containing minimum 80% calcium carbonate equivalent, with 99% passing a No. 8 sieve and 75% passing a No. 60 sieve.
2. Form: Dolomitic limestone.
3. Application: Apply lime per soil test recommendation to achieve target pH for optimal turf growth.

B. Water: Potable and sufficient for sod installation and initial irrigation.

2.04 FERTILIZER

A. Commercial Fertilizer: Neutral character, consisting of fast- and slow-release nitrogen, 50% derived from natural organic sources.

B. Starter Fertilizer at Installation:
1. Apply a starter fertilizer to promote sod establishment.
2. Recommended rate: 12–15 lb N per 1,000 sq ft, adjusted per soil test.

C. Annual Fertilization:
1. Nitrogen, phosphorus, and potassium shall be applied in amounts recommended by a qualified soil-testing agency.
2. Annual nitrogen application: not to exceed 4 lb N per 1,000 sq ft/year.

D. Phosphorus Restriction: Fertilizers shall contain 0% phosphorus unless soil test indicates deficiency.

E. N-P-K Example: 3N-0P-2K (or adjust per soil test).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive grass seed for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Scarify topsoil to depth of 2 inches in compacted areas.

B. Apply 5-10-5 fertilizer at the rate of 20 lb per 1000 sq ft or one lb of nitrogen per 1000 sq ft for other ratios. Rake fertilizer into top 2 inches of soil.
C. Water dry soil to a depth of 4 inches, 48 hours before sodding.

3.03 INSTALLATION

A. Begin sodding at bottom of slopes.
B. Install sod in strips, edge to edge, parallel to contours, with staggered joints.
C. Do not stretch or overlap sod.
D. Peg sod on slope ratio of 1 on 2 or steeper with minimum of two 8 inch stakes per square yard
E. Sprinkle sod immediately after installation.
F. Tamp or roll sufficiently to incorporate sod with topsoil.
G. Water sod and soil to depth of 4 inches within four hours after tamping or rolling.

3.04 LAWN ESTABLISHMENT

A. Maintain the sod at heights between 1-1/2 and 2-1/2 inches. Include a minimum of two (2) mowings.
B. Water sod once a week between April 1 and October 1. Provide 3 gallons per sq yd per watering. Apply fungicides or use any other horticultural operation necessary for proper establishment and maintenance of sodded areas.
C. Care for sodded areas until all Work of this Contract is completed and accepted.
D. Replace sod in areas which show bare spots, deterioration, or is otherwise deemed unacceptable by the Owner's Representative.

++END OF SECTION++

SECTION 32 9300
PLANTS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Trees.
   2. Shrubs.
   3. Topsoil and soil amendments.
   4. Fertilizers and mulches.
   5. Stakes and guys.
   6. Landscape edging and stone mulch for gravel drip strip.

1.2 SUBMITTALS

A. Product certificates signed by manufacturers certifying that their products comply with specified requirements.
   1. Manufacturer's certified analysis for standard products.
   2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
   3. Label data substantiating that trees, shrubs, and planting materials comply with specified requirements.
   4. Product data for stakes, guys, webbing, watering bags, and landscape edging.

B. Samples of each of the following:
   1. One (1) lb sample of organic and stone mulches required for Project, in labeled plastic bags.
   2. Twelve (12) inch sample of the landscape edging.

C. Material tests:
   1. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
   2. Analysis of imported topsoil.

D. Planting schedule indicating anticipated dates and locations for each type of planting.

E. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year including watering and maintaining all plantings diligently for 3 consecutive months

immediately after initial planting. Submit before expiration of required maintenance periods.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

B. Nursery Stock:
1. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock".
2. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

C. Topsoil Analysis:
1. Engage at no cost to the Owner a qualified independent soil-testing agency to provide a soil analysis stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil with recommendations as to quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.
2. Include topsoil source information.

D. Measurements:
1. Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position.
2. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes.
3. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Packaged Materials:
1. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer.
2. Protect materials from deterioration during delivery and while stored at site.

C. Trees and Shrubs:
   1. Deliver freshly dug trees and shrubs.
   2. Do not prune before delivery, except as approved by Architect.
   3. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage.
   4. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.
   5. Provide protective covering during delivery.
   6. Do not drop trees and shrubs during delivery.
   7. Immediately after digging bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

D. Handle balled and burlapped stock by the root ball.

E. Deliver trees and shrubs after preparations for planting have been completed and install immediately.

F. Planting:
   1. If planting is delayed more than six hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.
   2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
   3. Do not remove container-grown stock from containers before time of planting.
   4. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.5 PROJECT CONDITIONS

A. Utilities:
   1. Determine location of above grade and underground utilities and perform work in a manner which will avoid damage.
   2. Hand excavate, as required.
   3. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Engineer before planting.

1.6 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

B. Plant trees and shrubs between April 1 and June 1, or between September 1 and November 1.
   1. Do not plant when the ground is frozen, or excessively wet, or during drought and heat of the summer.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.
   1. Trees.
   2. Shrubs.

C. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season.

D. Replace planting materials that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

E. A limit of one replacement of each plant material will be required, except for losses or replacements due to failure to comply with requirements.

PART 2 PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

D. Only native plant material is used in the Project. Substitutions of non-native plants will not be accepted.

2.2 DECIDUOUS TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required.

B. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1.

C. Provide balled and burlapped trees.

2.3 SHRUBS

A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

B. Provide balled and burlapped or container grown shrubs.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.

B. Provide balled and burlapped coniferous evergreens.

2.5 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7.5, organic content between 5% and 10%, free of stones 1 inch or larger in any dimension, roots, plants, sods, clay lumps and other extraneous materials harmful to plant growth.

B. Topsoil Source: Amend existing soil stockpiled on the site to produce topsoil. Supplement with imported topsoil when required. Obtain topsoil from

naturally well-drained sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.

2.6 SOIL AMENDMENTS

A. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

B. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

C. Water: Potable.

2.7 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:
   1. Composition for Trees and Shrubs: not less than 5 percent nitrogen, 0 percent phosphorous, and 5 percent potassium (5N-0P-5K), by weight.
   2. Composition based on soil reports: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.
   3. Rates for Shrubs: 2-3 lbs/100sq of planting bed.
   4. Rates for Trees: 5lbs/1 inch of trunk diameter.

2.8 MULCH

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Single hammer milled hardwood bark.

B. Stone Mulch for Gravel Drip Strip: Hard, durable natural round gravel, washed free of loam, sand, clay, and other foreign substances, color: range of tan and brown, complying with NYS DOT Article 703-02 for screened gravel and the following gradation requirements:

Sieve Size	Percent Passing by Weight
1-inch	100

1/2-inch	90-100
1/4-inch	0-15
No. 200	0-1

2.9 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches by 84 inches long, pointed at one end.

B. Tree Tie Webbing: 3/4-inch wide polypropylene tree tie webbing tape soft and smooth, with 900 lb tensile strength, lock stitch design to prevent unraveling, and very low stretch.

C. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.10 MISCELLANEOUS MATERIALS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's instructions.

B. Watering Bags: TreeGator or approved equivalent 20 gal. watering bags with reinforced cording and drip holes. Use one bag per each tree or shrub.

C. Landscape Edging: Heavy duty commercial grade aluminum landscape edging, manufactured of 6063 alloy containing silicon and magnesium as the major alloying elements, 6 inches deep with wall thickness of 0.115 inches and 24 inches long stakes , Permaloc CleanLine XL, or approved equivalent.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, and secure Architect’s approval before the start of planting work. Make minor adjustments as may be required.

3.3 PLANTING SOIL PREPARATION

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

B. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

C. A “Planting Soil Amendments Schedule” is included at the end of this Section.

D. For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.

3.4 EXCAVATION FOR TREES

A. Pits and Trenches:
   1. Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.
   2. Balled and Burlapped Trees: Excavate approximately 2 times as wide as ball diameter and equal to ball depth.
   3. In areas of crushed stone backfill, excavate crushed stone minimum 5 times as wide as ball or container diameter and 18 inches minimum deeper than depth of a root ball. Compact imported soil under root balls to avoid tree or shrub sinking.

B. Dispose of subsoil removed from landscape excavations. Do not mix with planting soil or use as backfill.

C. Obstructions:
   1. Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
   2. Hardpan Layer: Drill 6-inch-diameter holes into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

E. Fill excavations with water and allow to percolate out, before positioning trees and shrubs.

3.5 PLANTING TREES AND SHRUBS

A. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

B. Place stock on bottom of planting pit.

C. Remove burlap and wire baskets from tops of balls and partially from sides, but do not remove from under balls. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.

D. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

E. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

F. Carefully remove containers so as not to damage root balls.

G. Place stock on bottom of planting pit.

H. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

I. Dish and tamp top of backfill to form a 3-inch- high mound around the rim of the pit. Do not cover top of root ball with backfill.

3.6 TREE GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 60 inches above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with tree tie webbing but in a manner as to avoid rigid restraint of tree movement.

B. Guying and Staking: Guy and stake evergreen trees unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches long, driven to grade. Attach flags to each webbing, 30 inches above finish grade.

3.7 TREE AND SHRUB MAINTENANCE

A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings.

B. Spr$ay as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

C. Maintain trees and shrubs for the following period:
   1. Maintenance Period: 12 months following Substantial Completion. Contractor to water and maintain all plantings diligently for 3 consecutive months immediately after initial planting.

3.8 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are size after pruning.

3.9 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Organic Mulch:
   1. Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems.
   2. Thickness: 3 inches.

3.10 INSTALLATION OF GRAVEL DRIP STRIP

A. Excavate trench along the building wall to dimensions indicated. Do not damage building walls. Install edging per manufacturer's instructions and so the top is +/-1/2-inch below finished grade. Place one layer of filter fabric. Overlap edges min 6 inches. Fill trench with stone mulch to finished grade.

3.11 INSTALLATION OF MISCELLANEOUS MATERIALS

A. Apply antidesiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.

B. When deciduous trees or shrubs are moved in full-leaf, spray with antidesiccant at nursery before moving and again 2 weeks after planting.

3.12 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

3.14 PLANTING SOIL AMENDMENTS SCHEDULE

A. Tree Pits or Trenches: Provide soil amendments in not less than the following quantities:
   1. Ratio of loose peat humus to topsoil by volume: 2 parts.
   2. Weight of commercial fertilizer per cu. ft.: 1/2 lbs.

B. Shrub Beds: Provide soil amendments in not less than the following quantities:
   1. Ratio of loose peat humus to topsoil by volume: 2 parts.
   2. Weight of commercial fertilizer100 sq. ft.: 2-3 lbs.

++END OF SECTION++

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SECTION 33 0130.13
SEWER AND MANHOLE TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Testing of Gravity Sewer Piping:
   a. Low pressure air testing.
2. Deflection testing of plastic sewer piping.
3. Testing of Manholes:
   a. Vacuum testing.

1.2 SUBMITTALS

A. Submit the following items prior to start of testing:
1. Testing procedures.
2. List of test equipment.
3. Testing sequence schedule.
4. Provisions for disposal of flushing and test water.
5. Certification of test gage calibration.
6. Deflection mandrel drawings and calculations.

B. Test and Evaluation Reports: Indicate results of manhole and piping tests.

A. Vacuum Equipment:
1. Vacuum pump.
2. Vacuum line.
3. Vacuum Tester Base:
   a. Compression band seal.
   b. Outlet port.
4. Shutoff valve.
5. Stopwatch.
6. Plugs.
7. Vacuum Gage: Calibrated to 0.1 in Hg.

B. Exfiltration Equipment:
1. Plugs.
2. Pump.
3. Measuring device.

C. Air Equipment:
1. Air compressor.
2. Air supply line.
3. Shutoff valves.
4. Pressure regulator.
5. Pressure relief valve.
6. Stopwatch.
7. Plugs.
8. Pressure Gage: Calibrated to 0.1 psi.

D. Hydrostatic Equipment:
1. Hydro pump.
2. Pressure hose.
3. Water meter.
4. Test connections.
5. Pressure relief valve.
6. Pressure Gage: Calibrated to 0.1 psi.

E. Deflection Equipment:
1. "Go, no go" mandrels.
2. Pull/retrieval ropes.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that manholes and piping are ready for testing.

B. Verify that trenches are backfilled.

C. Verify that pressure piping thrust restraint system is installed.

3.2 PREPARATION

A. Lamping:
1. Lamp gravity piping after flushing and cleaning.
2. Perform lamping operation by shining light at one end of each pipe section between manholes.

3. Observe light at other end.
4. Pipe not installed with uniform line and grade will be rejected.
5. Remove and reinstall rejected pipe sections.
6. Reclean and lamp until pipe section is installed to uniform line and grade.

B. Plugs:
1. Plug outlets, wye branches, and laterals.
2. Brace plugs to resist test pressures.

3.3 FIELD QUALITY CONTROL

A. Testing of Gravity Sewer Piping:
1. Low Pressure Air Testing:
   a. Test each reach of gravity sewer piping between manholes.
   b. Introduce air pressure slowly to approximately 25 psig.
      1) Determine ground water elevation above spring line of piping.
      2) For every foot of ground water above spring line of piping, increase starting air test pressure by 4 psi.
      3) Do not increase pressure above 35 psig.
   c. Allow pressure to stabilize for at least five minutes.
   d. Adjust pressure to 25 psig or to increased test pressure as determined above when ground water is present.
2. Do not make allowance for laterals.
3. Minimum Testing Duration in Minutes per 100 feet:
   a. Pipe Size 8 Inches : 1.2.
   b. Pipe Size 10 Inches : 1.5.
   c. Pipe Size 12 Inches : 1.8.
   d. Pipe Size 15 Inches : 2.1.
   e. Pipe Size 18 Inches : 2.4.
4. Record drop in pressure during testing period.
5. If air pressure drops more than 3.5 psig during testing period, piping has failed.
6. If 3.5 psig air pressure drop has not occurred during testing period, piping is acceptable; discontinue testing.
7. If piping fails, test reach of piping in incremental stages until leaks are isolated, repair leaks, and retest entire reach between manholes.

B. Deflection Testing of Plastic Sewer Piping:
1. Perform vertical ring deflection testing on PVC and acrylonitrile butadiene styrene sewer piping after backfilling has been in place for at least 30 days but not longer than 3 months.
2. Ensure that allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.

3. Perform deflection testing using properly sized rigid ball or "go, no go" mandrel.
4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe, as determined by ASTM standard to which pipe is manufactured; measure pipe diameter in compliance with ASTM D2122.
5. Perform testing without mechanical pulling devices.
6. Locate, excavate, replace, and retest piping that exceeds allowable deflection.

C. Testing of Manholes:
1. Description:
   a. If air testing, test whenever possible prior to backfilling in order to more easily locate leaks.
   b. Repair both outside and inside of joint to ensure permanent seal.
   c. Test manholes with manhole frame set in place.
2. Vacuum test according to ASTM C1244 and following:
   a. Plug pipe openings; securely brace plugs and pipe.
   b. Inflate compression band to create seal between vacuum base and structure.
   c. Connect vacuum pump to outlet port with valve open, then draw vacuum to 10 in Hg.
   d. Close valve.
   e. Manhole Test Duration in Seconds:
      1) Diameter 4 Feet : 60
      2) Diameter 5 Feet : 70
      3) Diameter 6 Feet : 90
   f. Record vacuum drop during test period.
   g. If vacuum drop is greater than 1 in Hg during testing period, repair and retest manhole.
   h. If vacuum drop of 1 in Hg does not occur during test period, manhole is acceptable; discontinue testing.
   i. If vacuum test fails to meet 1 in Hg drop in specified time after repair, repair and retest manhole.
3. If unsatisfactory testing results are achieved, repair manhole and retest until result meets criteria.
4. Repair visible leaks regardless of quantity of leakage.

++END OF SECTION++

SECTION 33 0561
CONCRETE MANHOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Modular precast or cast-in-place concrete manholes and structures with cover frame, covers, anchorage, and accessories.
   2. Doghouse manhole connections to existing pipelines..

1.2 SUBMITTALS

A. Comply with standard Submittal Procedures.

B. Cast-in-Place structures covered by this section shall be submitted under Section 03 3000.

1.3 QUALITY ASSURANCE

A. Perform Work according to New York State Department of Transportation standards.

B. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum of three years' experience.

C. Installer: Company specializing in performing Work of this Section with a minimum of three years' experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with precast concrete manufacturer's instructions for unloading, storing, and moving precast manholes and drainage structures.

B. Storage:
   1. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
   2. Repair property damaged from materials storage.

PART 2 PRODUCTS

2.1 MANHOLES

A. Manhole Sections:

1. Includes bases, risers, flat top slabs, and conical tops.
2. Reinforced precast concrete conforming to ASTM C478.
3. Joints between precast sections: Tongue and groove conforming to ASTM C990 and AASHTO M198. Confined groove or single offset joints conforming to ASTM C443.

B. Cast-in-place concrete shall be in accordance with Section 03 30 00.

2.2 ACCESSORIES

A. Resilient Connectors:
   1. 10 Degree Slope or Less:
      a. In accordance with ASTM C923.
      b. Wedge-style connector with Type 316 stainless steel hardware for sanitary sewer service and Type 304 or Type 316 for storm sewer service.
      c. Permanent marking indicating date and production run.
      d. Factory installed meeting manufacturers torque requirements.
      e. Manufacturers:
         1) Kor-N-Seal, by Trelleborg.
         2) PSX Direct Drive, by Press Seal Corporation.
         3) Or approved equal.

B. Vented Frames and Covers
   1. Frames
      a. ASTM A48, gray iron, class 35B
      b. Heavy duty, HS25
      c. Machined surfaces
      d. Uncoated
      e. AASHTO M306
      f. Made in the U.S.A.
      g. EJ Group, Inc. “1545Z3” or equal.
   2. Covers
      a. ASTM A48, gray iron, class 35B
      b. Heavy duty
      c. Machined surfaces
      d. Uncoated
      e. AASHTO M306
      f. Two 1 1/8” open pick holes
      g. Shall read “SANITARY SEWER” or “STORM DRAIN” based on service.
      h. Made in the U.S.A.
      i. EJ Group, Inc. “1544C” or equal.

2.3 WATERPROOFING

A. Koppers “Bitumastic Super Service Black”.

B. Mobil “Hi-Build Bituminous Coating”.

C. Or equal.

PART 3 EXECUTION

A. Verify that items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location and are ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated to indicate its intended use.

B. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.

C. Do not install manholes where Site conditions induce loads exceeding structural capacity of manholes or structures.

D. Inspect precast concrete manholes immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION

A. Installation Standards: Install work according to NYSDOT standards.

B. Excavation and Backfill:
   1. Excavate for manholes and structures as specified in Section 31 2316, Site Excavation, and at indicated locations and depths.
   2. Provide clearance around sidewalls of manhole for construction operations, granular backfill, and placement of geotextile filter fabric.
   3. If groundwater is encountered, prevent accumulation of water in excavations; place manhole in dry trench.

4. Backfill Excavation for manholes as specified in Section 31 2316, Site Excavation, and Section 31 2323, Fill.

C. Foundation Slab:
1. Place foundation slab and trowel top surface level.
2. Place manhole sections plumb and level, trim to correct elevations, and anchor to foundation slab.

D. Form and place manhole or structure cylinder plumb and level, to indicated dimensions and elevations.

E. As Work progresses, install steps and other fabricated metal items.

F. Waterproofing:
1. All manholes shall be waterproofed on the outside with two coats of the specified waterproofing material.
2. Manholes upon completion shall be watertight.

G. Precast Concrete Manholes:
1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Set precast structures, bearing firmly and fully on crushed stone bedding, compacted as specified in Section 31 23 16, Site Excavation, and 31 23 23, Fill, or on other support system as indicated on Drawings.
4. Manholes, in all cases, shall be completely constructed and fitted with their frames and covers as the work progresses and as each structure is reached.
5. All castings shall be thoroughly cleaned and free from rust.
6. Assembly:
   a. Assemble multi-section manholes and structures by lowering each section into excavation.
   b. Install joints between precast sections according to manufacturer's recommendations.
   c. Lower, set level, and firmly position base section before placing additional sections.
7. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.
8. Maintain alignment between sections by using guide devices affixed to lower section.
9. Verify that installed manholes meet required alignment and grade.
10. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe.

11. Cut pipe flush with interior of structure.
12. Shape inverts through manhole as indicated on Drawings.

H. Pipe to Manhole Connections:
1. Cut and fit for pipe to connect to structures indicated on Drawings.
2. Where resilient connectors are installed, concrete used to form the manhole channel shall not be permitted under the pipe protruding through the manhole wall.
3. Field install using torque wrenches approved by the manufacturer.

I. Sanitary Manhole Drop Connections:
1. Construct drop connections into sanitary manholes as indicated on Drawings.
2. All pipe and fittings at the top and the one at the bottom of the drop shall be included and constructed as part of the manhole as shown on the Drawings.

J. Channels, Inverts, and Benches:
1. At Contractor's option, channels, inverts, and benches may be factory precast concrete or in-situ formed cast-in-place concrete.

K. Ground Water Testing:
1. Ground water test pipes shall be provided in each manhole where required by the Contract Documents.
2. The test pipes shall be 3/4-inch diameter galvanized steel with hot dip bituminous coating, nine inches long with a ninety degree elbow and threaded cap.
3. The test pipe shall be set at an elevation of two inches above the bench wall and eight inches from the center line of the manhole steps.
4. The pipes shall be grouted into the precast manhole wall with a non-shrink grout.

3.4 FIELD QUALITY CONTROL

A. Test concrete manhole and structure sections according to ASTM C497.

B. Vertical Adjustment of Existing Manholes and Structures:
1. If required, adjust top elevation of existing manholes and structures to finished grades as indicated.
2. Frames, Grates, and Covers:
   a. Remove frames, grates, and covers cleaned of mortar fragments.
   b. Reset to required elevation according to requirements specified for installation of castings.
3. Reinforcing Bars:

a. Remove concrete without damaging existing vertical reinforcing bars if removal of existing concrete wall is required.
b. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement as indicated.

4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 03 3000, Cast-in-Place Concrete.

++END OF SECTION++

SECTION 33 4200
STORMWATER CONVEYANCE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Corrugated, solid-wall HDPE drainage pipe.
   2. End sections for stormwater piping.
   3. Drainage structures.
   4. Frames, grates, and covers for drainage structures.

B. Related Work specified elsewhere:
   1. Section 31 0513, Soils for Earthwork.
   2. Section 31 0516, Aggregates for Earthwork.
   3. Section 31 0519.13, Geotextiles for Earthwork.
   4. Section 31 3700, Riprap.
   5. Section 32 9200, Turf and Grasses.

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. American Association of State Highway and Transportation Officials (AASHTO)
      a. M198, Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
      b. M252, Standard Specification for Corrugated Polyethylene Drainage Pipe
      c. M294, Standard Specification for Corrugated Polyethylene Pipe, (12- to 60-in.) Diameter
   2. ASTM International (ASTM):
      a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      b. A497, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
      c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
      d. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
      e. C478, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
      f. C923, Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals

g. D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
h. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
i. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

3. Federal Specifications (FS):
   a. RR F 621C, Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
4. State of New York Department of Transportation, Standard Specifications.

1.03 SUBMITTALS

A. Shop drawings:
   1. Drainage structures.
   2. Frames, grates, and covers.

B. Manufacturer's Material Specifications:
   1. Pipe, end sections, fittings, joints, couplings, and gaskets.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Piping:
   1. Inspect materials delivered to site for damage.
   2. Store materials on site in enclosures or under protective coverings.
   3. Store plastic piping and rubber gaskets under cover, out of direct sunlight.
   4. Do not store materials directly on the ground.
   5. Keep inside of pipes and fittings free of dirt and debris.

C. Drainage Structures:
   1. Avoid chipping and breakage of precast concrete drainage structures and sections; store as directed.
   2. Protect masonry materials and precast concrete from exposure to weather; keep dry until used.
   3. Use of precast concrete containing frost shall not be permitted.

D. Metal Items:
   1. Inspect upon arrival; identify and segregate as to types, functions, and sizes.
   2. Store items to afford easy accessibility and to prevent excessive rusting or coating with grease or other objectionable materials.
   3. Do not store materials directly on the ground.

E. Handling:
   1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound, undamaged condition.
   2. Carry pipe to trench; dragging of pipe shall not be permitted.

PART 2 - PRODUCTS

2.01 SMOOTH INTERIOR CORRUGATED POLYETHYLENE PIPE (SICPP)

A. Smooth interior corrugated polyethylene pipe and fittings shall conform to the requirements of AASHTO M294, Type S (12 to 36 inch diameter). The maximum interior pipe surface coefficient of roughness (Manning's n) shall be 0.012. Shape, dimensions, and thickness shall be as shown on the Plans.

2.02 END SECTIONS FOR STORMWATER PIPING

A. Galvanized steel end sections shall conform to the requirements of Section 706-12 of the New York State Standard Specifications, latest edition.

B. All smooth interior corrugated polyethylene pipe and galvanized steel end sections shall be designed to be joined by couplings or other positive mechanical means approved by the Engineer.

2.03 DRAINAGE STRUCTURES

A. Drainage structures shall include drainage manholes, catch basins, drop inlets, field inlets, drain basins, and special drainage chambers or structures as shown on the Plans, specified, or directed.

B. Precast concrete drainage structures shall be designed for AASHTO HS-20 traffic loading and conform to the requirements of ASTM C478, except as specified herein. Provide an air content of 6 percent, plus or minus 2 percent and a minimum wall thickness of 8 inches. Cast-in-place concrete structures will not be allowed.
   1. Joints between precast concrete structure sections shall be of a compressible gasket type, watertight and conform to ASTM C443 or AASHTO M198, Type B gaskets. The interior and exterior of the joint shall finished with a waterproof mortar grout.
   2. Pipe to wall connections shall be mortared to produce smooth transitions and watertight joints or provided with ASTM C923 resilient connectors.
   3. Drainage structure steps shall be as shown on the Plans, specified or directed.

2.04 FRAMES, GRATES, AND COVERS FOR DRAINAGE STRUCTURES

A. Drainage structure frames, grates, covers, and castings shall be East Jordan Iron Works pattern 5419 or approved equal and shall be of cast iron construction in conformance with Fed. Spec. RR F 621. They shall be equal in quality and at least equal in weight to those referred to on the Plans by the manufacturer's catalog numbers. Frames, grates, and covers in paved areas shall be AASHTO HS-20 traffic design. Steel grates shall conform to the applicable requirements of NYSDOT, and be of welded construction. Surfaces of steel frames, grates, and covers shall be cleaned and hot dipped galvanized after fabrication in accordance with ASTM A123. Drainage manhole frames and covers shall be supplied with eccentric cam lug locking devices when specified or shown. All drainage manhole and catch basin frames, grates, and covers shall be machined to provide non-rocking covers or grates.

PART 3 - EXECUTION

3.01 PIPING

A. Inspect pipe and fittings before and after installation to ensure no defective materials are incorporated in the work. Defective piping shall be replaced with new materials.

B. All pipe shall be handled and assembled in accordance with manufacturer's instructions except as modified on the Plans or by the Engineer's written order.

C. All pipe shall be laid in reasonably close conformity to line and grade and shall have a full firm and even bearing at each joint and along the entire length of pipe. Pipe installation shall begin at the downstream end and progress upstream. Provide tools and appliances for the safe and convenient handling, lowering, and installation of pipe sections into location. Provide batterboards spaced not more than 26 feet apart along the trench or use the laser beam method for ensuring proper slope and elevation. Any single run of pipe shall consist wholly of the same material unless otherwise directed by the Engineer.

D. Connections and embedment shall be performed in strict accordance with all manufacturer's recommendations and as indicated on the Plans. All connections shall be an approved type, fabricated and installed so that a secure and firm pipe connection may be readily made in the field. In making pipe joints, keep space between pipe and coupling free from dirt and grit so that corrugations will fit snugly.

E. At the end of each working day, the upper end of the installed pipe shall be plugged temporarily with a stopper to prevent the entry of dirt and other substances into the pipe. The stopper shall be left in place and shall be removed only just prior to installation of the next section of pipe.

F. Special care shall be exercised in placing and compacting material immediately adjacent to pipes in order to avoid damage to the pipe and to prevent pipe misalignment. Movement of construction equipment, vehicles, and loads over and adjacent to any pipe shall be done at the Contractor's risk.

G. Any pipe, which in the judgment of the Engineer is damaged or disturbed through any cause, shall be replaced or removed, cleaned, and reinstalled as directed by the Engineer at the expense of the Contractor and at no cost to the Owner.

H. No pipe shall be covered with material in excess of 20 feet without review of procedures by the manufacturer.

3.02 DRAINAGE STRUCTURES

A. Except as specified herein, the Contractor shall acquire from the precast concrete structure manufacturer adequate handling and installation instructions to insure the safe, proper and undamaged installation of the structure. The instructions shall be adequate to insure that all joints in the installed structure are properly sealed so as to prevent infiltration of water. At the time of installation of the structure, the manufacturer shall provide his own representative to advise on the installation.

B. The Contractor will be required to excavate the area where the structure is to be installed and prepare the subgrade using fill as shown on the Plans and as directed by the Engineer. Prior to and during the placement of any lining and/or the installation of the structure, the Contractor shall dewater the excavation as required and in the manner. The structure is to be carefully lowered into the excavation by suitable equipment, in such manner as to prevent damage to the structure. Backfill around the structure shall be of suitable material, placed and compacted as specified.

C. Lifting eyes of other similar devices shall be cut off or ground flush with the surface. If necessary, all holes left by lifting devices shall be grouted.

D. Drainage structure steps may be bolted in place during construction or mortared with a concrete grouting material after the structure is completed. The steps shall clear all pipes. Steps in risers and conical top sections shall be aligned to form a continuous ladder with rungs equally spaced vertically in the completed manhole at a maximum distance of 16 inches. Steps shall be embedded into the walls of the riser or conical top section a minimum of 3

inches. The rung shall project a minimum clear distance of 4 inches from the walls of the riser or conical sections measured from the point of embedment.

3.03 METAL WORK

A. Workmanship and Finish: Form iron to shape and size with sharp lines and angles. Provide shearing and punching to produce clean, true lines and surfaces. Make castings sound and free from warp and blowholes that may impair strength or appearance. Provide exposed surfaces with a smooth finish and sharp, well defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary. After installation, remove mortar, dirt, and other deleterious materials from frames, covers, gratings, and steps.

3.04 FIELD TESTS AND INSPECTIONS

A. General: Perform field tests and provide labor, equipment, and incidentals required for testing.

B. Piping Test: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole, catch basin, or other structure; a practically full circle of light shall show through the pipeline when viewed from the adjoining end of line.

++END OF SECTION++

SECTION 33 4213
PIPE CULVERTS

PART 1 GENERAL

1.1 GENERAL

A. Furnish all labor, materials, equipment, and incidental Work necessary to install pipe culverts, as shown on the Drawings and as specified herein.

B. Section includes:
1. Ductile iron pipe culverts.
2. Reinforced concrete pipe culverts.
3. Corrugated steel pipe culverts
4. Polyethylene pipe culverts.

B. Related Work specified elsewhere:
1. Section 03 3000, Cast-in-Place Concrete.
2. Section 31 0513, Soils for Earthwork.
3. Section 31 0516, Aggregates for Earthwork.
4. Section 31 2316, Site Excavation.
5. Section 31 2316.13, Trenching.
6. Section 31 2323, Fill.
7. Section 33 4600, Subdrainage.

1.2 REFERENCE STANDARDS

A. The following is a list of standards that may be referenced in this Section:
1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M36, Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
   b. M86, Standard Specification for Nonreinforced Concrete, Sewer, Storm Drain, and Culvert Pipe.
   c. M170, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   d. M196, Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.

e. M206, Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
f. M207, Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
g. M252, Standard Specification for Corrugated Polyethylene Drainage Pipe.
h. M288, Standard Specification for Geotextile Specification for Highway Applications.
i. M294, Standard Specification for Corrugated Polyethylene Pipe, 12- to 60-in. Diameter.
j. T180, Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

2. ASTM International (ASTM):
a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
b. A746, Standard Specification for Ductile Iron Gravity Sewer Pipe.
c. B745, Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
d. C14, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
e. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
f. C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
g. C506, Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
h. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
i. ASTM C1103, Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
j. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
k. D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
l. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

m. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
n. D2680, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
o. D2729, Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
p. D2855, Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
q. D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
r. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
s. F405, Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
t. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
u. F667, Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.

1.3 SUBMITTALS

A. Comply with standard submittal procedures.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cast Iron Soil Pipe (CISP):
   1. Pipe:
      a. Hub and spigot, in accordance with ASTM A74.
      b. Extra heavy (XH) weight.
   2. Joints: Rubber gaskets, per ASTM C564.
   3. Fittings: Conform to ASTM A74.
   4. Coating: Bituminous coated inside and out, marked with manufacturer's name or trademark and CISPI symbol.

B. Ductile Iron Pipe (DIP)
   1. Pipe:
      a. Conform to ASTM A746.

b. Pressure class:
   1) 3-inch to 12-inch: 350.
   2) 14-inch to 20-inch: 250.
   3) 24-inch to 64-inch: 200.
c. Joints: push-on with rubber gaskets conforming to AWWA C111.
d. Fittings: ductile iron conforming to AWWA C110, lined and coated the same as the adjoining pipe.

2. Lining:
   a. Polyethylene:
      1) 40-mil nominal ultraviolet resistant compound consisting of a blend of high and low density polyethylene powder conforming to ASTM D1248 carbon black and inert filler.
      2) Bond to interior of pipe and fittings by heat.
      3) Preheat pipe in furnace to ensure uniformity of heat distribution to an adequate temperature to provide uniform fusing of polyethylene powders and to provide bonding to pipe and fittings.
      4) Lining shall cover interior surface from plain or beveled end to rear of gasket socket.
      5) Coat ends and exterior of ends to a point 1 inch outside gasket position with minimum 8-mil dry film thickness coal tar epoxy.

3. Polyethylene wrap and tape for ductile iron pipe:
   a. Polyethylene wrap: 8 mils, minimum thickness, conforming to AWWA C105.
   b. Adhesive tape: Thermoplastic pressure sensitive, minimum thickness of 8 mils, minimum of 1 inch.

C. POLYVINYL CHLORIDE PIPE (PVC)

1. 15-inch diameter and smaller:
   a.. Conform to ASTM D3034.
   b. Joints: Integral bell and spigot, in accordance with ASTM D3212.
   c. Minimum SDR: 26.
   d. Cell classification: 12454-B or 12454-C, as defined by ASTM D1784.
   e. Fittings: SDR 35, minimum wall thickness.
   f. Gaskets: factory fabricated rubber compression type with solid cross section in accordance with ASTM F477. Lubricant for joining pipe as approved by the pipe manufacturer.
2. 18-inch through 36-inch diameter:

a. Comply with ASTM F679.
b. Joints: Integral bell and spigot, in accordance with ASTM D3212.
c. Minimum pipe stiffness: 46 psi, when tested in accordance with ASTM D2412.
d. Cell classification: Minimum 12454-C, as defined by ASTM D1784.
e. Fittings: Wall thickness no less than wall thickness of equivalent size of pipe.
f. Gaskets: factory fabricated rubber compression type with solid cross section conforming to ASTM F47.

D. Reinforced concrete pipe (RCP):
1. Conform to the requirements of this Section and ASTM C76 for Class III.
2. Minimum wall thickness: as shown on the Drawings.
3. Modified and special designs are not permitted.
4. Joints:
a. General:
1) Use rubber gasket type with “captive gasket in groove” design.
2) Joint mating length shall provide allowance for manufacturer’s allowable joint deflection, reset joint opening to allow for joint deflection, and allowances as necessary to ensure positive gasket sealing during joint movement.
3) Joints shall be manufactured with steel joint rings.
5. Concrete joints:
a. Push-on, self-centering bell and spigot type, using rubber gaskets.
b. Joints and gaskets shall conform to ASTM C443. Lubricant for joining pipe, as approved by the pipe manufacturer.
c. Flared bell type joints that provide full wall thickness at both bell and spigot shall form a watertight seal capable of resisting internal and external water head of minimum of 30 feet.
6. Joints made with steel joint rings:
a. Push-on, self-centering bell and spigot type, using steel bell and spigot rings, conforming to the requirements of ASTM C361.
b. Flared bell type joints that provide full wall thickness at both bell and spigot, except for pipe wall more than 6 inches thick. Flush bells with steel joint rings conforming to requirements of ASTM A361 may be used.
c. Steel joint rings shall extend beyond bell or spigot at least 2 inches.

d. Shall form a watertight seal capable of resisting internal and external water head of minimum 30 feet.

7. Fabrication:
   a. Pipe:
      1) Manufacture using centrifugally spun process or we-cast in stationary vertical forms with concrete compacted by high-frequency vibration.
      2) Rotation packer or platform methods will not be allowed.
   b. Concrete pipe fittings and specials:
      1) Shop-fabricate as shown and designed for same internal and external pressures as adjoining pipe.
      2) Mitered pipe ends with maximum deflection angle of 10 degrees are acceptable.
      3) Maximum bend angle for bends shall be 22.5 degrees.
   c. Steel plate fittings and specials:
      1) Fabricated from steel plate, cement-mortar lined, and coated.
      2) Steel plate fittings shall conform to dimensional requirements of AWWA C208.
      3) Minimum steel plate thickness:
         a) Pipe 48-inch diameter and smaller: 3/16-inch, minimum.
         b) Pipe larger than 48-inch diameter: 3/8-inch, minimum.
      4) Line and coat steel fittings in accordance with AWWA C205.
   d. Cement:
      1) Conform to ASTM C150, Type II.
      2) Fly ash or other cement substitutes will not be allowed.
      3) Minimum cement content: 564 pounds per cubic yard of concrete.
      4) Maximum water-cement ratio: 0.49, by weight of concrete.
   e. Circumferential reinforcing:
      1) Only circular reinforcing shall be used. Elliptical, quadrant, and triple cage reinforcing arrangements shall not be permitted.
      2) In no case shall areas of reinforcement in each cage be less than that required b standard designs given in ASTM C76.

3) Modifications of required areas of reinforcing based on elliptical design shall not be used to reduce required reinforcing in either cage.
4) Design of concrete protective covering over reinforcing shall be 1 inch, minimum. In no case shall placement tolerances permit less than 3/4 inch of protective cover.
a) Increase wall thickness to provide required cover and to accommodate tolerances used in fabrication.
5) Wire fabric reinforcing shall be permitted for only single inner cage reinforcing patterns.
6) Provide firm and positive support of reinforcing to prevent movement during concrete placement.

f. Longitudinal reinforcing:
1) Equally-spaced ASTM A615, grade 40 bars.
2) Maximum spacing: 12 inches or 3 times wall thickness, whichever is less, but in no case less than a total of four bars.
3) Provide a minimum total cross-sectional area of reinforcing equal to 0.004 times gross concrete area of pipe wall.

g. Sand and aggregate: Nonreactive and shall conform to the requirements of AWWA C302.

h. Water: clean, potable, and free of objectionable quantities of organic matter, alkali, salts, and other impurities. Agricultural water with total dissolved solids exceeding 1,000 mg/L or plant recycle water shall not be used.

i. Curing shall be in accordance with the requirements of AWWA C302.

j. Marking:
1) Each pipe section shall be marked in accordance with the requirements of ASTM C76.
2) In addition, each pipe section shall be marked with the laying number associated with the laying schedule.

E. Corrugated Polyethylene Pipe (CPP):
1. Smooth interior corrugated polyethylene pipe conforming to the requirements of Section 706-12 of the New York State Standard Specifications latest edition. The units shall conform to the shape, dimensions and thickness shown on the Contract Drawings or as listed in the Additional Instructions.

F. Polyethylene end sections shall conform to the requirements of Section 706-12 of the New York State Standard Specifications, latest edition.

G. All smooth interior corrugated polyethylene pipe and end sections shall be of the same manufacturer and shall be designed to be joined by couplings or other positive mechanical means approved by the Engineer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Smooth interior corrugated polyethylene pipe shall be installed in the locations shown on the Contract Drawings. Connections and embedment shall be performed in strict accordance with all manufacturer's recommendations and as indicated on the drawings.

B. All pipe shall be laid in reasonably close conformity to line and grade and shall have a full firm and even bearing at each joint and along the entire length of pipe. Pipe laying shall begin at the downstream end and progress upstream. Any single run of pipe, including end sections, shall consist wholly of the same material unless otherwise directed by the Engineer.

C. All pipe shall be handled and assembled in accordance with the Manufacturer's instructions except as modified on the Plans or by the Engineer's written order.

D. Special care shall be exercised in placing and compacting material immediately adjacent to pipes in order to avoid damage to the pipe and to prevent pipe misalignment.

E. Movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk.

F. Corrugated polyethylene pipe connections for making field joints shall consist of corrugated bands, so constructed as to lap on equal portions of each culvert section to be connected. All connections shall be an approved type, fabricated and installed so that a secure and firm pipe connection may be readily made in the field.

++END OF SECTION++

SECTION 33 4443
STORMWATER TREATMENT DEVICE

PART 1 - GENERAL

1.01 SUMMARY

A. This item shall govern the furnishing and installation of the Cascade Separator® by Contech Engineered Solutions LLC, complete and operable as shown and as specified herein, in accordance with the requirements of the plans and contract documents.

B. The Contractor shall furnish all labor, equipment and materials necessary to install the storm water treatment device(s) (SWTD) and appurtenances specified in the Drawings and these specifications.

C. Related Work specified elsewhere:
1. Section 31 0519.13: Geotextiles for Earthwork
2. Section 31 2316: Site Excavation
3. Section 31 2319: Dewatering
4. Section 31 2323: Fill
5. Section 31 4100: Shoring

1.02 SUBMITTALS

A. Action submittals:
1. Product information indicating:
    a. Manufacturer’s cut sheets and product information on all accessories supplied under this Section.
    b. Shop drawings showing the equipment, material and arrangement thereof including methods of ballasting.
    c. Complete materials of construction of all components included in the scope of supply.
    d. Manufacturer’s recommended installation instructions including handling procedures, anchoring, and layout.
    e. Contact information for at least one (1) authorized service center within 100 miles of the Project Site.
    f. Manufacturer’s Performance Certification certifying that each SWTD is capable of achieving the specified removal efficiencies listed in these specifications. The certification shall be supported by independent third-party research
2. Operation and Maintenance Manual:
    a. Provide written descriptions from the Manufacturer or recommended maintenance intervals, troubleshooting, and service requirements.

b. Provide complete parts list including manufacturer's part number indexed to and equipment diagram.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Inspect materials and equipment delivered to site for damage.

C. Exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the Contractor.

D. All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.04 WARRANTY

A. The manufacturer shall guarantee the SWTD components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months after notice of Owner's acceptance of the Work. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of SWTD components shall be limited to the application for which it was specifically designed.

B. All manufacturing defects found during the warranty period will be reported to the Manufacturer by the Owner and will be corrected by the Manufacturer at no cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Manufacturer of the SWTD shall be one that is regularly engaged in the engineering design and production of systems deployed for the treatment of storm water runoff for at least five (5) years and which have a history of successful production, acceptable to the Engineer.

B. Cascade Separator® hydrodynamic separator as designed and manufactured by Contech Engineered Solutions LLC, West Chester, Ohio, 1-800-338-1122.

2.02 MATERIALS

A. Housing unit of SWTD shall be constructed of pre-cast concrete. Precast concrete components shall conform to applicable sections of ASTM C 478, ASTM C 857 and ASTM C 858 and the following:
   1. Concrete shall achieve a minimum 28-day compressive strength of 4,000 pounds per square-inch (psi);
   2. Unless otherwise noted, the precast concrete sections shall be designed to withstand lateral earth and AASHTO H-20 traffic loads;
   3. Cement shall be Type III Portland Cement conforming to ASTM C 150;
   4. Aggregates shall conform to ASTM C 33;
   5. Reinforcing steel shall be deformed billet-steel bars, welded steel wire or deformed welded steel wire conforming to ASTM A 615, A 185, or A 497.
   6. Joints shall be sealed with preformed joint sealing compound conforming to ASTM C 990.
   7. Shipping of components shall not be initiated until a minimum compressive strength of 4,000 psi is attained or five (5) calendar days after fabrication has expired, whichever occurs first.

B. Internal Components and appurtenances shall conform to the following:
   1. Screen and support structure shall be manufactured of Type 316 and 316L stainless steel conforming to ASTM F 1267-01;
   2. Support brackets shall be manufactured of 5052 aluminum;
   3. Fiberglass components shall conform to the ASTM D-4097;
   4. Polypropylene copolymer components shall conform to a tensile strength of 3,600 psi (ASTM D-638), and Izod impact value of “no break” (ASTM D-256);
   5. Manhole castings shall be designed to withstand AASHTO H-20 loadings and manufactured of cast-iron conforming to ASTM A 48 Class 30.

2.03 PERFORMANCE

A. The SWTD shall be sized to either achieve an 80 percent average annual reduction in the total suspended solid load or treat a flow rate designated by the jurisdiction in which the project is located. Both methods should be sized using the OK-110 particle distribution having particles ranging from 53 microns to 212 microns with a d50 of around 110 microns.

B. The SWTD shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance

cycles. The minimum storage capacity provided by the sump chamber shall be in accordance with the volume listed in Table 1. The boundaries of the sump chamber shall be limited to that which do not degrade the SWTD's treatment efficiency as captured pollutants accumulate. In order to not restrict the Owner's ability to maintain the SWTD, the minimum dimension providing access from the ground surface to the sump chamber shall be 16 inches in diameter.

C. The SWTD shall be designed to capture and retain Total Petroleum Hydrocarbons generated by wet-weather flow and dry-weather gross spills and have a capacity listed in Table 1 of the required unit.

D. The SWTD shall convey the flow from the peak storm event of the drainage network, in accordance with required hydraulic upstream conditions as defined by the Engineer. If a substitute SWTD is proposed, supporting documentation shall be submitted that demonstrates equal or better upstream hydraulic conditions compared to that specified herein. This documentation shall be signed and sealed by a Professional Engineer registered in the State of the work. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

PART 3 - EXECUTION

3.01 STORAGE AND HANDLING

A. The contractor shall exercise care in the storage and handling of the SWTD components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

3.02 EXAMINATION

A. Verify layout and orientation of HDS and piping connections.

B. Verify that excavations, dimensions, and elevations are as indicated.

3.03 PREPARATION

A. Correct over-excavation with granular fill.

3.04 INSTALLATION

A. The SWTD shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. The manufacturer shall provide the contractor installation instructions and offer

on-site guidance during the important stages of the installation as identified by the manufacturer at no additional expense. A minimum of 72 hours notice shall be provided to the manufacturer prior to their performance of the services included under this subsection.

B. The contractor shall fill all voids associated with lifting provisions provided by the manufacturer. These voids shall be filled with non-shrinking grout providing a finished surface consistent with adjacent surfaces. The contractor shall trim all protruding lifting provisions flush with the adjacent concrete surface in a manner, which leaves no sharp points or edges.

3.05 CLEANING

A. The contractor shall removal all loose material and pooling water from the SWTD prior to the transfer of operational responsibility to the Owner.

3.06 SCHEDULES

A. Stormwater Treatment Device Storage Capacities
1. Table 1

Cascade Model	Minimum Sump Storage Capacity (yd3)	Minimum Oil Storage Capacity (gal)
CS-3	0.41	59.0
CS-4	0.70	141.0
CS-5	1.09	269.3
CS-6	1.57	475.9
CS-8	2.79	1128.0
CS-10	4.36	2203.2
CS-12	6.28	3807.1

++END OF SECTION++

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SECTION 33 4600
SUBDRAINAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Underdrainage system.
   2. Filter aggregate.

B. Related Work specified elsewhere:
   1. Section 31 0516, Aggregates for Earthwork.

1.2 SUBMITTALS

A. Product Data: Submit data on pipe drainage products and pipe accessories.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Polyvinyl chloride (PVC) pipe: Conform to ASTM D2729; perforated; plain end, 4 and 6 inch inside diameter, with required fittings.

2.2 FILTER AGGREGATE

A. Filter aggregate:
   1. Comply with Drainage Fill gradation in accordance with Section 31 0516, Aggregates for Earthwork.

B. Filter sand:
   1. Comply with Sand Fill gradation in accordance with Section 31 0516, Aggregates for Earthwork.

2.3 ACCESSORIES

A. Pipe Coupling: Solid plastic.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify excavation base is ready to receive work.

B. Hand trim excavations. Correct over excavation with Filter Aggregate.

3.2 INSTALLATION

A. Loosely butt pipe ends. Place joint cover strip 12-in wide around pipe diameter centered over joint.

B. Place pipe with perforations facing down. Mechanically join pipe ends.

C. Place drainage tile on minimum 4 inch deep bed of coarse filter aggregate.

D. Lay pipe to slope gradients noted on Drawings.

E. Install coarse aggregate at sides, over joint covers and top of pipe. Install top cover compacted thickness of 12 inches.

F. Place filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations.

G. Place aggregate in maximum 4 inch lifts, consolidate each lift.

H. Increase compaction of each successive lift. Do not displace or damage pipe when compacting.

++END OF SECTION++

SECTION 33 4601
STORMWATER MANAGEMENT AREAS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corrugated, perforated HDPE drainage pipe.
   2. Corrugated, non-perforated HDPE drainage pipe.
   3. End sections for stormwater piping.
   4. Stormwater area drains and inlets.
   5. Gratings and frames for stormwater drainage inlets.
   6. Bioretention area requirements.

B. Related Work specified elsewhere:
   1. Section 31 3700, Riprap.
   2. Section 32 9200, Turf and Grasses.
   3. Section 32 9300, Plants.
   4. Section 31 2319, Dewatering
   5. Section 31 2323, Fill

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. American Association of State Highway and Transportation Officials (AASHTO)
      a. M198, Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
      b. M252, Standard Specification for Corrugated Polyethylene Drainage Pipe
      c. M294, Standard Specification for Corrugated Polyethylene Pipe, (12- to 60-in.) Diameter
   2. ASTM International (ASTM):
      a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      b. A497, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
      c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
      d. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
      e. C478, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

f. C923, Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals
g. D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
h. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
i. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

3. Federal Specifications (FS):
   a. RR F 621C, Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
4. State of New York Department of Transportation, Standard Specifications.

1.3 SUBMITTALS

A. Shop drawings:
   1. Drainage structures.
   2. Metal work, frames, grates, and covers.
   3. Trench drains and grates.

B. Manufacturer's Material Specifications:
   1. Pipe, underdrain tubing, end sections, fittings, joints, couplings, and gaskets.
   2. Geotextile and geomembrane.

C. Material Certifications:
   1. Stone and soil products

1.4 DELIVERY, STORAGE, AND HANDLING

A. Piping: Inspect materials delivered to site for damage. Store materials on site in enclosures or under protective coverings. Store plastic piping and rubber gaskets under cover, out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

B. Drainage Structures: Avoid chipping and breakage of precast concrete drainage structures and sections; store as directed. Protect masonry materials and precast concrete from exposure to weather; keep dry until used. Use of precast concrete containing frost shall not be permitted.

C. Metal Items: Inspect upon arrival; identify and segregate as to types, functions, and sizes. Store items to afford easy accessibility and to prevent excessive rusting or coating with grease or other objectionable materials. Do not store materials directly on the ground.

D. Handling: Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound, undamaged condition. Carry pipe to trench; dragging of pipe shall not be permitted.

PART 2 PRODUCTS

2.1 CORRUGATED, PERFORATED HDPE DRAINAGE PIPE.

A. Perforated smooth interior corrugated polyethylene underdrain tubing and fittings shall conform to the requirements of AASHTO M252, Type SP (4 to 10 inch diameter) with AASHTO Class II perforations. Tubing and fittings greater than 12 inch diameter shall meet the requirements of AASHTO M252, except the pipe stiffness requirement shall be 45 psi at 5% deflection. Shape, dimensions, and thickness shall be as shown on the Plans.

2.2 CORRUGATED, NON-PERFORATED HDPE DRAINAGE PIPE.

A. Smooth interior corrugated polyethylene pipe and fittings shall conform to the requirements of AASHTO M294, Type S (12 to 36 inch diameter). The maximum interior pipe surface coefficient of roughness (Manning's n) shall be 0.012. Shape, dimensions, and thickness shall be as shown on the Plans.

2.3 END SECTIONS FOR STORMWATER PIPING.

A. Polyethylene end sections (12 to 36 inch diameter) shall be of the same manufacturer as attached piping and shall be designed to be joined by polyethylene couplings, of the type specified, or other positive mechanical means approved by the Engineer.

2.4 STORMWATER AREA DRAINS AND INLETS.

A. Drainage structures shall include drainage manholes, catch basins, drop inlets, field inlets, drain basins, and special drainage chambers or structures as shown on the Plans, specified, or directed.

B. Precast concrete drainage structures shall be designed for AASHTO HS-20 traffic loading and conform to the requirements of ASTM C478, except as specified herein. Provide an air content of 6 percent, plus or minus 2 percent and a minimum wall thickness of 5 inches. Cast-in-place concrete structures will not be allowed.

1. Joints between precast concrete structure sections shall be of a compressible gasket type, watertight and conform to ASTM C443 or AASHTO M198, Type B gaskets. The interior and exterior of the joint shall finished with a waterproof mortar grout.

2. Pipe to wall connections shall be mortared to produce smooth transitions and watertight joints or provided with ASTM C923 resilient connectors.
3. Drainage structure steps shall be as shown on the Plans, specified or directed.

C. Drain basins shall be as manufactured by Nyloplast, a division of Advanced Drainage Systems, Inc., or approved equal, and manufactured from PVC pipe stock.
1. Pipe to drain basin connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. The joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477.

2.5 GRATINGS AND FRAMES FOR STORMWATER DRAINAGE INLETS.

A. Drainage structure frames, grates, covers, and castings shall be East Jordan Iron Works pattern 5419 or approved equal and shall be of cast iron construction in conformance with Fed. Spec. RR F 621. They shall be equal in quality and at least equal in weight to those referred to on the Plans by the manufacturer's catalog numbers. Frames, grates, and covers in paved areas shall be AASHTO HS-20 traffic design. Steel grates shall conform to the applicable requirements of NYSDOT, and be of welded construction. Surfaces of steel frames, grates, and covers shall be cleaned and hot dipped galvanized after fabrication in accordance with ASTM A123. Drainage manhole frames and covers shall be supplied with eccentric cam lug locking devices when specified or shown. All drainage manhole and catch basin frames, grates, and covers shall be machined to provide non-rocking covers or grates.

B. Drain basin frames and grates shall be ductile iron of the size specified and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting various wheel loads as specified.

2.6 BIORETENTION AREA REQUIREMENTS.

A. Bioretention Soil.
1. A uniform mix, free of stones, stumps, roots, or other objects larger than two inches (2") in diameter. The Bioretention soil shall be visibly free of noxious weeds.

2. A well-blended mixture of three (3) parts concrete sand and one (1) part topsoil, by volume. The Bioretention soil shall have a pH range of 5.2 to 7.6, and an organic content of 3-7%. Sand shall meet the requirements of NYSDOT Section 703-07 Concrete Sand. Topsoil shall be in accordance with the requirements of NYSDOT Section 713-01 Topsoil for Topsoil Type A.
3. Soil amendments to increase organic content shall be peat moss. Peat moss shall be commercially produced and shall be composed of the partly decomposed stems and leaves of any or several species of sphagnum moss. It shall be free from wood, decomposed colloidal residue, and other foreign matter. It shall have a pH range between 3.5 to 5.5. Its water absorbing ability shall be a minimum of 1100% by weight on an oven-dry basis.
4. Acceptance of Bioretention Soil will be based upon a material certification that the material conforms to the above requirements. The Contractor shall provide to the Engineer copies of testing results of the sand gradation, topsoil gradation, organic content percentage of the bioretention soil, and pH of the bioretention soil.

B. Filter Fabric: Mirafi 140N or approved equal.

C. Underdrain Filter: Conforming to New York State Department of Transportation Standard Specifications Section 733-20, Underdrain Filter, Type 1.

PART 3 EXECUTION

3.1 PIPING.

A. Inspect pipe and fittings before and after installation to ensure no defective materials are incorporated in the work. Defective piping shall be replaced with new materials.

B. All pipe shall be handled and assembled in accordance with manufacturer's instructions except as modified on the Plans or by the Engineer's written order.

C. All pipe shall be laid in reasonably close conformity to line and grade and shall have a full firm and even bearing at each joint and along the entire length of pipe. Pipe installation shall begin at the downstream end and progress upstream. Provide tools and appliances for the safe and convenient handling, lowering, and installation of pipe sections into location. Provide batterboards spaced not more than 26 feet apart along the trench or use the laser beam method for ensuring proper slope and elevation. Any single run of pipe,

including end sections, shall consist wholly of the same material unless otherwise directed by the Engineer.

D. Connections and embedment shall be performed in strict accordance with all manufacturer's recommendations and as indicated on the Plans. All connections shall be an approved type, fabricated and installed so that a secure and firm pipe connection may be readily made in the field. In making pipe joints, keep space between pipe and coupling free from dirt and grit so that corrugations will fit snugly.

E. At the end of each working day, the upper end of the installed pipe shall be plugged temporarily with a stopper to prevent the entry of dirt and other substances into the pipe. The stopper shall be left in place and shall be removed only just prior to installation of the next section of pipe.

F. Special care shall be exercised in placing and compacting material immediately adjacent to pipes in order to avoid damage to the pipe and to prevent pipe misalignment. Movement of construction equipment, vehicles, and loads over and adjacent to any pipe shall be done at the Contractor's risk.

G. Any pipe, which in the judgment of the Engineer is damaged or disturbed through any cause, shall be replaced or removed, cleaned, and reinstalled as directed by the Engineer at the expense of the Contractor and at no cost to the Owner.

H. No pipe shall be covered with material in excess of 20 feet without review of procedures by the manufacturer.

I. Corrugated metal slotted pipe shall be installed in conformance with the Plans, Specifications, and manufacturer's recommendations. If there are any inconsistencies or conflicts, the contractor must bring them to the attention of the Engineer.

3.2 DRAINAGE STRUCTURES.

A. Except as specified herein, the Contractor shall acquire from the precast concrete structure manufacturer adequate handling and installation instructions to insure the safe, proper and undamaged installation of the structure. The instructions shall be adequate to insure that all joints in the installed structure are properly sealed so as to prevent infiltration of water. At the time of installation of the structure, the manufacturer shall provide his own representative to advise on the installation.

B. The Contractor will be required to excavate the area where the structure is to be installed and prepare the subgrade using granular fill as shown on the Plans

and as directed by the Engineer. Prior to and during the placement of any lining and/or the installation of the structure, the Contractor shall dewater the excavation as required and in the manner specified under Section 31 2319. The structure is to be carefully lowered into the excavation by suitable equipment, in such manner as to prevent damage to the structure. Backfill around the structure shall be of suitable material, placed and compacted as specified in Section 31 2323 Fill.

C. Lifting eyes of other similar devices shall be cut off or ground flush with the surface. If necessary, all holes left by lifting devices shall be grouted.

D. Drainage structure steps may be bolted in place during construction or mortared with a concrete grouting material after the structure is completed. The steps shall clear all pipes. Steps in risers and conical top sections shall be aligned to form a continuous ladder with rungs equally spaced vertically in the completed manhole at a maximum distance of 16 inches. Steps shall be embedded into the walls of the riser or conical top section a minimum of 3 inches. The rung shall project a minimum clear distance of 4 inches from the walls of the riser or conical sections measured from the point of embedment.

E. Where shown or specified, the bench walls of standard and drop drainage manholes shall be constructed of Class "C" concrete to an elevation equal to the inside top of the main sewer. The top of the bench wall shall have an increasing slope, away from the channel, as shown on the Plans. All channels shall be constructed to conform to the invert of the pipe and permit a smooth and uninterrupted flow through the manhole.

3.3 DRAIN BASIN INSTALLATION

A. Install in accordance with manufacturer’s recommendations and as shown on Plans, specified, and/or as directed. Prepare subgrade as required. Cut drain basin body at required height following final grading. Backfill around the structure shall be as shown on the Plans, specified, or directed by the Engineer.

B. Drain basins shall not be used for load rated installations unless otherwise directed and approved by the Engineer.

3.4 BIORETENTION SOIL INSTALLATION:

A. Bioretention soil shall be installed at the location(s) and to the depth(s) as shown on the plans.

B. Placement of bioretention soil shall be done in lifts of 12 to 18 inches. The soil shall be loosely compacted by tamping lightly with a vibratory plate compactor or backhoe bucket.

C. No other materials or substances shall be mixed or dumped within the bioretention soil that may be harmful to plant growth, or prove a hindrance to planting or maintenance operations.

3.5 GEOTEXTILE INSTALLATION

A. The placement of the geotextile shall not be conducted during adverse weather conditions. The geotextile will be kept dry during storage and up to the time of deployment. All geotextiles will be secured with sandbags or an equivalent approved anchoring system. Removal of the sandbags or equal will only occur upon placement of an overlying soil layer.

B. Proper cutting tools shall be used to cut and size the geotextile materials. Extreme care will be taken while cutting in-place geotextiles.

C. During the placement of geotextiles, all dirt, dust, sand or mud shall be kept off to prevent clogging. If excessive contaminant materials are present on the geotextile, it shall be cleaned or replaced as directed by the Engineer.

D. No equipment used will damage the geotextiles by handling, trafficking or other means. Equipment, including ATVs, will not be allowed to travel directly on the geotextiles during the installation of overlying soils or geosynthetic layers, unless otherwise approved by the Engineer. Any damage to the material from the equipment shall be repaired by the Contractor at no additional cost to the Owner.

E. Geotextiles shall be overlapped a minimum of twelve inches.

3.6 METAL WORK:

A. Workmanship and Finish: Form iron to shape and size with sharp lines and angles. Provide shearing and punching to produce clean, true lines and surfaces. Make castings sound and free from warp and blowholes that may impair strength or appearance. Provide exposed surfaces with a smooth finish and sharp, well defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary. After installation, remove mortar, dirt, and other deleterious materials from frames, covers, gratings, and steps.

3.7 FIELD TESTS AND INSPECTIONS:

A. General: Perform field tests and provide labor, equipment, and incidentals required for testing.

B. Piping Test: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole, catch basin, or other structure; a practically full circle of light shall show through the pipeline when viewed from the adjoining end of line.

++END OF SECTION++

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SECTION 33 4623
CMP UNDERGROUND DETENTION AND INFILTRATION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This item shall govern the furnishing and installation of Underground Detention and Infiltration System for all types, sizes and designations as shown on the plans.

B. Contractor shall furnish all labor, materials, equipment and incidentals necessary to install the CMP System, appurtenances and incidentals in accordance with the Drawings and as specified herein.

C. A stormwater treatment device upstream of the CMP System is proposed as the appropriate means of pretreating for the purpose of extending the maintenance interval on the CMP System and reducing the life cycle cost. Both engineered solutions shall be provided by a single supplier/manufacturer. Filtration by wrapping a system with geotextile is not an acceptable means of pretreatment.

D. Related Work specified elsewhere:
1. Section 31 0519.13: Geotextiles for Earthwork
2. Section 31 2316: Site Excavation
3. Section 31 2319: Dewatering
4. Section 31 2323: Fill
5. Section 31 4100: Shoring

E. Related Specifications:
1. American Association of State Highway and Transportation Officials (AASHTO)
    a. AASTHO Design Section 12 – Soil-Corrugated Metal Structure Interaction Systems
    b. AASHTO Construction Section 26 – Metal Culverts
    c. AASHTO M196 – Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
    d. AASHTO M197 – Standard Specification for Aluminum Alloy Sheet for Corrugated Aluminum Pipe
2. American Society for Testing and Materials (ASTM)
    a. ASTM B744: Standard Specification for Aluminum Alloy Sheet for Corrugated Aluminum Pipe
    b. ASTM B745: Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains

c. ASTM B788: Standard Practice for Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe
d. ASTM A998: Standard Practice for Structural Design of Reinforcements for fittings in Factory-Made Corrugated Steel Pipe for Sewers and Other Applications

1.02 SUBMITTALS

A. Action submittals:
1. Product information indicating:
a. Manufacturer's cut sheets and product information on all accessories supplied under this Section.
b. Shop drawings showing the equipment, material and arrangement thereof including methods of ballasting.
c. Complete materials of construction of all components included in the scope of supply.
d. Manufacturer's recommended installation instructions including handling procedures, anchoring, and layout.
e. Contact information for at least one (1) authorized service center within 100 miles of the Project Site.
2. Operation and Maintenance Manual:
a. Provide written descriptions from the Manufacturer or recommended maintenance intervals, troubleshooting, and service requirements.
b. Provide complete parts list including manufacturer's part number indexed to and equipment diagram.
3. Shop drawings shall be annotated to indicate all materials to be furnished and installed under this section, and all applicable standards for materials, required tests of materials and design assumptions for structural analysis:
a. Before installation of the CMP System, Contractor shall obtain the written approval of the EOR for the stormwater system and the installation drawings.
4. All proposed alternatives to the CMP System shall conform to applicable above referenced AASHTO and ASTM specifications. NCSPA provides design service life guidance for certain products up to 100 years in recommended environments.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 6100, Common Product Requirements.

B. Inspect materials and equipment delivered to site for damage.

C. Exercise care in the storage and handling of the CMP System components prior to and during installation. Any repair or replacement costs associated

with events occurring after delivery is accepted and unloading has commenced shall be borne by the Contractor.

D. All components shall be subject to inspection by the engineer at the place of manufacture and/or installation. All components are subject to being rejected or identified for repair if the quality of materials and manufacturing do not comply with the requirements of this specification. Components which have been identified as defective may be subject for repair where final acceptance of the component is contingent on the discretion of the Engineer.

1.04 WARRANTY

A. The manufacturer shall guarantee the CMP System components against all manufacturer originated defects in materials or workmanship for a period of twelve (12) months after notice of Owner's acceptance of the Work. The manufacturer shall upon its determination repair, correct or replace any manufacturer originated defects advised in writing to the manufacturer within the referenced warranty period. The use of CMP System components shall be limited to the application for which it was specifically designed.

B. All manufacturing defects found during the warranty period will be reported to the Manufacturer by the Owner and will be corrected by the Manufacturer at no cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Manufacturer of the CMP System shall be one that is regularly engaged in the engineering design and production of systems deployed for the infiltration and detention of storm water runoff for at least fifteen (15) years and which have a history of successful production, acceptable to the Engineer.

B. Contech Engineered Solutions LLC, West Chester, Ohio, 1-800-338-1122.

2.02 MATERIALS

A. Aluminum material shall conform to the applicable requirements of AASHTO M197 or ASTM B744. CMP shall be manufactured in accordance with the applicable requirements of AASHTO M196 or ASTM B745.

B. The pipe sizes, gauges and corrugations shall be as shown on the project plans. Joint performance requirements are published in Division II, Section 26.4.2, of the current edition of the AASHTO Bridge Construction Specifications.

C. Soil tight, gravity flow, non-pressure, drainage pipe joints shall conform to AASHTO M196 and ASTM B745. Minimum joint spacing shall be 10 ft.

D. Overlapping of adjacent pipes are not permitted and appropriate banding must be utilized in order to properly secure individual pipes in place.

E. Integral End Sections: Each barrel of the CMP System shall either be connected to a fitting composing a manifold for hydraulic distribution or have an integrated bulkhead to resist loading at the end/start of the barrel, end cap sections shall not be permitted.

F. Material selected shall be flame resistant and capable of retaining 80% of strength when subjected to a temperature of 400 degrees Fahrenheit for one hour.

G. All fittings shall be manufactured prior to arriving on the jobsite to ensure structural integrity. Fitting reinforcement shall be in accordance with ASTM A998 and reinforcing details.

H. Sampling, testing, and inspection of metal sheets and coils used for manufacturing the CMP System shall be in accordance with to the above applicable referenced specifications. All fabrication of the product shall occur within the United States.

2.03 PERFORMANCE

A. The CMP System proposal shall be sized in accordance to the design provided and approved by the Engineer of Record (EOR). Any Contractor deviating from the design shown on the plans, to include: material, footprint, etc., shall provide to the EOR a summary report on stage-storage curves, design calculations, HydroCAD modeling and engineering drawings.

B. The CMP System shall comprise of manhole access with minimum dimensions of 24 inches diameter to provide adequate inspection and maintenance without restrictions and obstructions to entry into interior of the CMP System. Manholes shall be provided to allow full entry into and visual inspection of the complete CMP System, at a minimum as to allow full maintenance of the CMP System. Cleanouts or inspection ports are not acceptable access points for maintenance and inspection nor are any other alternatives which do not allow for full entry into the system.

C. CMP spacing, gage (thickness) and stone base thickness can be altered with consultation from Contech Engineered Solutions, LLC.

D. The CMP System shall be designed for a minimum HS-20/HS-25 final live loading conditions. The CMP System shall meet HS-20/HS-25 loading

requirements with a minimum of 12-inches of cover to bottom of flexible pavement for pipe spans less than or equal to 96 inches and 18 inches of cover to bottom of flexible pavement for pipe spans greater than 96 inches.

E. The CMP System shall be designed so as the hydraulic grade line will increase evenly throughout whereas transverse movement from one storage compartment to another shall not be permitted. All storage compartments shall be connected via manifold (or connecting pipe) versus by transporting stormwater through stone.

PART 3 - EXECUTION

3.01 STORAGE AND HANDLING

A. The contractor shall exercise care in the storage and handling of the CMP System components prior to and during installation. Any repair or replacement costs associated with events occurring after delivery is accepted and unloading has commenced shall be borne by the contractor.

3.02 EXAMINATION

A. Verify layout and orientation of CMP System and piping connections.

B. Verify that excavations, dimensions, and elevations are as indicated.

3.03 PREPARATION

A. Correct over-excavation with granular fill.

3.04 INSTALLATION

A. The CMP System installation shall be in accordance with AASHTO Standard Specifications for Highways Bridges, Section 26, Division II or ASTM B788 and in conformance with the project plans and specifications.

B. The CMP System shall be installed in accordance with the manufacturer's recommendations and related sections of the contract documents. Handling & assembly shall be in accordance with National Corrugated Steel Pipe Association's (NCSPA) recommendations.

C. For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the pipe. The Height-of-Cover shall meet the minimum requirements shown in the table below. The use of heavy construction equipment necessitates greater protection for the pipe than finished grade cover minimums for normal highway traffic. See Table 1 below.

D. Minimum cover may vary, depending on local conditions. The contractor must provide the additional cover required to avoid damage to the pipe. Minimum cover is measured from the top of the pipe to the top of the maintained construction roadway surface.

E. Refer to the Contech's Corrugated Metal Pipe Detention Design Guide for additional guidance regarding installation, inspection and maintenance.

F. The contractor shall follow Occupational Safety and Health Association (OSHA) guidelines for safe practices in executing the installation process in accordance with the manufacturer/supplier installation recommendations.

G. Backfill material shall be placed in 8 inch loose lifts and compacted to 90% AASHTO T99 standard proctor density.

H. Supplier will conduct an on-site preconstruction meeting with the contractor prior to the scheduled delivery date of the CMP System.

3.05 SCHEDULES

A. Minimum Cover Requirements
1. Table 1

Pipe Span (inches)	Axle Load (kips)			
	18 - 50	50 - 75	75 - 110	110 – 150
12 - 42	3.0	3.5	4.0	4.0
48 – 72	4.0	4.0	5.0	5.5
78 - 120	4.0	5.0	5.5	5.5

++END OF SECTION++

APPENDIX

11/03/2021

Project:
Edgemont School District-
Seely Elementary School
Equipment Cut Data

From:
Raymond/ Raymond Associates
Brett Farrell
44 St. John Street
Goshen, NY 10924
(845) 360-5112

To:

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EAGLE GROUP®
Profit from the Eagle Advantage®

Specification Sheet

Item No.: _____
Project No.: _____
S.I.S. No.: _____

Hand Sinks* with Towel and/or Soap Dispenser

MODELS:
- ❑ ***HSA-10-FDP***
- ❑ ***HSA-10-FDPS***
- ❑ ***HSA-10-FLDP***
- ❑ ***HSA-10-FODP***
- ❑ ***HSA-10-FWLDP-LRS***

Short Form Specifications

Eagle Hand Sink, model HSA-10-FDP. Constructed of type 304 stainless steel, all-welded with deep-drawn positive drain sink bowl, inverted "V" edge to prevent spillage, drain, paper towel dispenser, soap dispenser and splash mounted gooseneck faucet.

Eagle Hand Sink, model HSA-10-FDPS. Features are the same as #HSA-10-FDP, plus stainless steel sink skirt.

Eagle Hand Sink, model HSA-10-FLDP. Features are the same as #HSA-10-FDP, plus polymer lever drain.

Eagle Hand Sink, model HSA-10-FODP. Features are the same as #HSA-10-FDP, plus polymer lever drain with overflow.

Eagle Hand Sink, model HSA-10-FWLDP-LRS. Features splash mount gooseneck faucet with wrist handles, towel displenser, soap dispenser, polymer lever drain, and end splashes.



#HSA-10-FDP

Design & Construction Features

- Heavy gauge type 304 stainless steel all-welded construction.
- Inverted "V" edge rim retards spillage.
- Backsplash with a 2˝ (51mm) return on a 45° angle.
- ½˝ (13mm) NPS water inlet, 1½˝ (38mm) NPS drain outlet.
- Unique deep-drawn positive-drain bowl assures complete drainage to meet the most stringent health code requirements.
- All-welded towel dispenser features hinged top assembly, sight window to visually inspect towel level, quick-fill soap dispenser, and is designed to accommodate 4˝ x 10˝ (102 x 254mm) C-fold disposable paper towels.
- Comes with mounting bracket to facilitate wall mount installation.

Options / Accessories

- ❑ P-trap
- ❑ Tail piece
- ❑ End splashes
- ❑ Front skirt**
- ❑ Side mount wall bracket
- ❑ MICROGARD® antimicrobial agent***

** Front skirt available only for models HSA-10-FDP and HSA-10-FDPS.
*** For hand sinks #HSA-10-FDP and #HSA-10-FDPS only.

* Non-electric. For hand sinks with electric soap dispenser and faucets, see spec sheet #20.42.
For hand sinks with deck-mounted soap dispensers, see spec sheets #EG20.05 and #EG20.07.

EAGLE GROUP
100 Industrial Boulevard, Clayton, DE 19938-8903 USA
Phone: 302-653-3000 • Fax: 302-653-2065
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Foodservice Division: Phone 800-441-8440
MHC/Retail Display Divisions: Phone 800-637-5100

Certifications / Approvals

NSF

AUTOQUOTES

KCL

For custom configuration or fabrication needs, contact our **SpecFAB® Division.**
Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

EG20.41 Rev. 09/14

Spec sheets available for viewing, printing or downloading from our online literature library at *www.eaglegrp.com*

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EG20.41 Catalog Specification Sheet No.

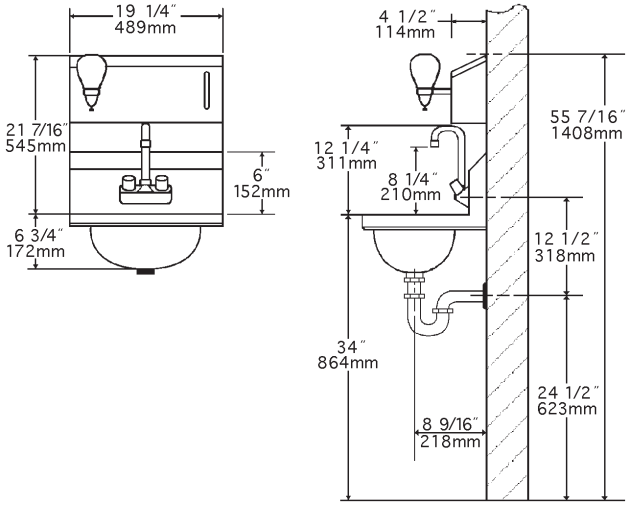
Hand Sinks with Towel and/or Soap Dispenser

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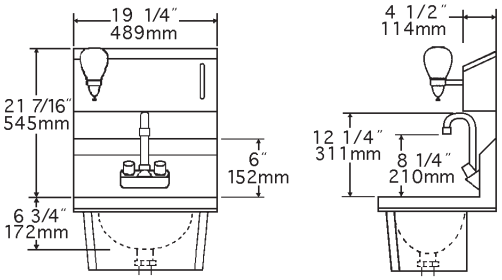
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Hand Sinks with Towel and/or Soap Dispensers

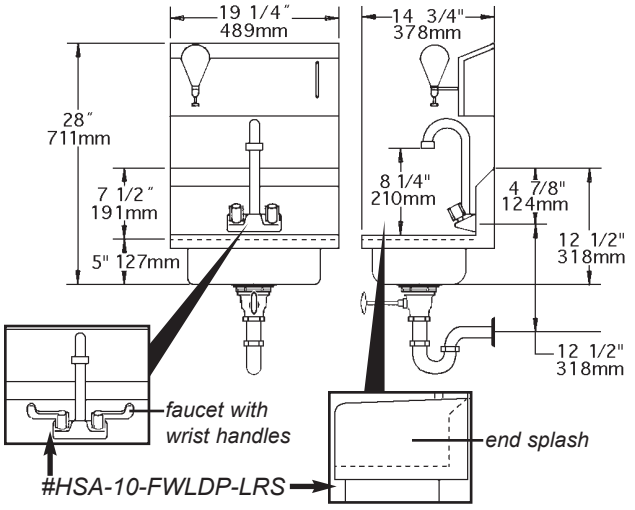
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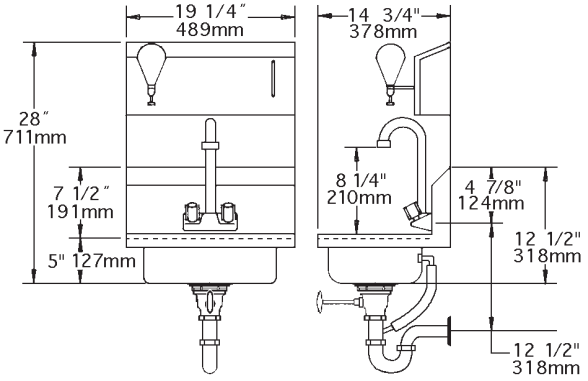
HSA-10-FDPS



HSA-10-FLDP / HSA-10-FWLDP-LRS



HSA-10-FODP



model #	includes towel dispenser, soap dispenser, and…	bowl size width x length x depth in.	bowl size mm	overall size width x length x height in.	overall size mm	weight lbs.	weight kg
HSA-10-FDP	faucet, basket drain	9¾″ x 13½″ x 6¾″	248 x 343 x 173	14¾″ x 19¼″ x 28¼″	376 x 489 x 718	29	13.2
HSA-10-FDPS	faucet, skirt, basket drain	9¾″ x 13½″ x 6¾″	248 x 343 x 173	14¾″ x 19¼″ x 30″	376 x 489 x 762	29	13.2
HSA-10-FLDP	faucet, polymer lever drain	10″ x 14″ x 5″	254 x 256 x 127	14¾″ x 19¼″ x 28″	376 x 489 x 711	32	14.5
HSA-10-FODP	faucet, polymer lever drain w/overflow	10″ x 14″ x 5″	254 x 256 x 127	14¾″ x 19¼″ x 28″	376 x 489 x 711	30	13.6
HSA-10-FWLDP-LRS	faucet w/wrist handles, poly lever drain, end splashes	10″ x 14″ x 5″	254 x 256 x 127	14¾″ x 19¼″ x 28″	376 x 489 x 711	30	13.6

EAGLE GROUP
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Profit from the Eagle Advantage®

Specification Sheet

Item No.: _____
Project No.: _____
S.I.S. No.: _____

Spec-Master® FN Series Coved Corner Three-Compartment Sinks

Short Form Specifications

Eagle Spec-Master® Three-Compartment Sinks, model _____. Unit constructed of 14 gauge 300 series, 18-8 stainless steel throughout. Sink bowls coved with a full ⅝″ radius, and shall have a 14″ water level. Drainboards, when required, shall be "V" creased for positive drainage. 9½″ high backsplash with 1″ upturn and tile edge. Legs to be 1⅝″ O.D., stainless steel, with stainless steel gussets, stainless steel crossbracing and adjustable stainless steel bullet feet.



3-compartment sink
(faucets not included)

MODELS:

❑ ***FN2048-3-**** ❑ ***FN2472-3-****
❑ ***FN2054-3-**** ❑ ***FN2860-3-****
❑ ***FN2060-3-****

** See table on back for complete model numbers.*

Top:

- Drainboards, backsplash and rolled rims are 14 gauge 300 series stainless steel.
- Drainboards, when provided, are integrally welded.
- All rolled edges are highlighted for enhanced appearance.
- 9½″ high backsplash with 1″ upturn and tile edge.
- 1⅛″ (29mm) faucet holes* punched on 8″ (203mm) centers.

Base:

- Legs: 1⅝″ (41mm)-diameter stainless steel tubing with stainless steel gussets and fully adjustable stainless steel bullet feet.
- Crossbracing: Adjustable, 1¼″ (32mm)-diameter stainless steel; running left-to-right and front-to-back.
- Leg locations fall directly under sink bowls**, providing increased stability and maximum weight support.
- Leg gussets welded to a die-cut heavy-gauge stainless steel reinforcing corner plate.
- Legs are crossbraced on all sides for increased stability.

Sink Bowls:

- 14 gauge 300 series stainless steel.
- 14″ (356mm) water level, 17″ (432mm) flood level.
- Sink compartments are coved on a full ⅝″ (41mm) radius and constructed using state-of-the-art seamless welding techniques.
- Basket-type waste drain fits sink bowls' 3½″ (89mm) opening and features 1½″ (38mm) outlet.

* Three-compartment sinks with 20″ x 16″ (508 x 406mm) bowls have one set of faucet holes. All others feature two sets of faucet holes.

** On sinks with drainboard(s) 30″ or longer, legs are located underneath the outer end of drainboard(s).

Options / Accessories

❑ Lever drain
❑ Lever drain with overflow
❑ Twist handle drains
❑ Overflow hole
❑ Sink kits
❑ Faucets
❑ Polyboard sink covers
❑ Stainless steel sink covers
❑ Skirted front panel

Assembly:

- Entire assembly is fuse-welded and planished, providing a one-piece seamless sink unit.
- Welded areas are high-speed belt blended to match adjacent surfaces with continuity of satin finish.
- All outside corners of assembly are bullnosed to provide safe, clean edges.
- Water supply is ½″ (13mm) NPS for hot and cold lines.

Certifications / Approvals

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AutoQuotes

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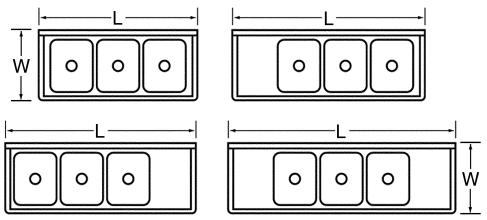
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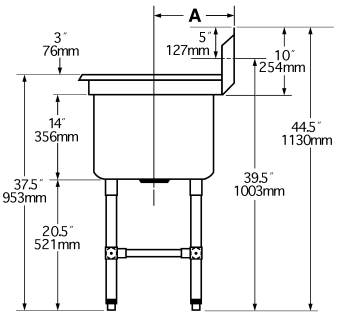
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Project No.: _____
S.I.S. No.: _____

Spec-Master® FN Series Coved Corner Three-Compartment Sinks



Drain location for rough-in

bowl width in.	bowl width mm	bowl length in.	bowl length mm	Dimension A	
20″	508	16″	406	14″	356
20″	508	18″	457	14″	356
20″	508	20″	508	14″	356
24″	610	24″	610	16″	406
28″	711	20″	508	18″	457



model #	BOWL DIMENSIONS width in.	width mm	length in.	length mm	DRAINBOARD quantity	length in.	length mm	OVERALL DIMENSIONS width in.	width mm	length in.	length mm	weight lbs.	weight kg
FN2048-3-14/3	20″	508	16″	406	0	-		27″	686	57″	1448	99	44.9
FN2048-3-18R or ***L-14/3***	20″	508	16″	406	1	18″	457	27″	686	73½″	1867	118	53.5
FN2048-3-18-14/3	20″	508	16″	406	2	18″	457	27″	686	90″	2286	137	61.7
FN2048-3-24R or ***L-14/3***	20″	508	16″	406	1	24″	610	27″	686	79½″	2019	124	56.2
FN2048-3-24-14/3	20″	508	16″	406	2	24″	610	27″	686	102″	2591	149	67.6
FN2048-3-30R or ***L-14/3***	20″	508	16″	406	1	30″	762	27″	686	85½″	2172	129	58.5
FN2048-3-30-14/3	20″	508	16″	406	2	30″	762	27″	686	114″	2896	159	72.1
FN2048-3-36R or ***L-14/3***	20″	508	16″	406	1	36″	914	27″	686	91½″	2324	134	60.8
FN2048-3-36-14/3	20″	508	16″	406	2	36″	914	27″	686	126″	3200	169	76.7
FN2054-3-14/3 *	20″	508	18″	457	0	-		27″	686	63″	1600	102	46.3
FN2054-3-18R or ***L-14/3 ****	20″	508	18″	457	1	18″	457	27″	686	79½″	2019	121	54.9
FN2054-3-18-14/3 *	20″	508	18″	457	2	18″	457	27″	686	96″	2438	140	63.5
FN2054-3-24R or ***L-14/3 ****	20″	508	18″	457	1	24″	610	27″	686	85½″	2172	127	57.6
FN2054-3-24-14/3 *	20″	508	18″	457	2	24″	610	27″	686	108″	2743	158	71.6
FN2054-3-30R or ***L-14/3 ****	20″	508	18″	457	1	30″	762	27″	686	91½″	2324	132	59.9
FN2054-3-30-14/3 *	20″	508	18″	457	2	30″	762	27″	686	120″	3048	162	73.5
FN2054-3-36R or ***L-14/3 ****	20″	508	18″	457	1	36″	914	27″	686	97½″	2477	137	62.1
FN2054-3-36-14/3 *	20″	508	18″	457	2	36″	914	27″	686	132″	3358	172	78.0
FN2060-3-14/3 *	20″	508	20″	508	0	-		27″	686	69″	1753	114	51.7
FN2060-3-18R or ***L-14/3 ****	20″	508	20″	508	1	18″	610	27″	686	85½″	2172	133	60.3
FN2060-3-18-14/3 *	20″	508	20″	508	2	18″	457	27″	686	102″	2591	152	68.9
FN2060-3-24R or ***L-14/3 ****	20″	508	20″	508	1	24″	457	27″	686	91½″	2324	139	63.1
FN2060-3-24-14/3 *	20″	508	20″	508	2	24″	610	27″	686	114″	2896	164	74.4
FN2060-3-30R or ***L-14/3 ****	20″	508	20″	508	1	30″	762	27″	686	97½″	2477	144	65.3
FN2060-3-30-14/3 *	20″	508	20″	508	2	30″	762	27″	686	126″	3200	174	78.9
FN2060-3-36R or ***L-14/3 ****	20″	508	20″	508	1	36″	914	27″	686	103½″	2629	149	67.6
FN2060-3-36-14/3 *	20″	508	20″	508	2	36″	914	27″	686	138″	3505	184	83.5
FN2472-3-14/3 *	24″	610	24″	610	0	-		31″	787	81″	2057	127	57.6
FN2472-3-18R or ***L-14/3 ****	24″	610	24″	610	1	18″	457	31″	787	97½″	2477	146	66.2
FN2472-3-18-14/3 *	24″	610	24″	610	2	18″	457	31″	787	114″	2896	165	74.8
FN2472-3-24R or ***L-14/3 ****	24″	610	24″	610	1	24″	610	31″	787	103½″	2629	152	68.9
FN2472-3-24-14/3 *	24″	610	24″	610	2	24″	610	31″	787	126″	3200	177	80.3
FN2472-3-30R or ***L-14/3 ****	24″	610	24″	610	1	30″	762	31″	787	109½″	2769	157	71.2
FN2472-3-30-14/3 *	24″	610	24″	610	2	30″	762	31″	787	138″	3505	187	84.8
FN2472-3-36R or ***L-14/3 ****	24″	610	24″	610	1	36″	914	31″	787	115½″	2934	162	73.5
FN2472-3-36-14/3 *	24″	610	24″	610	2	36″	914	31″	787	150″	3810	197	89.4
FN2860-3-14/3 *	28″	711	20″	508	0	-		35″	889	69″	1753	130	59.0
FN2860-3-18R or ***L-14/3 ****	28″	711	20″	508	1	18″	457	35″	889	85½″	2172	149	67.6
FN2860-3-18-14/3 *	28″	711	20″	508	2	18″	457	35″	889	102″	2591	168	76.2
FN2860-3-24R or ***L-14/3 ****	28″	711	20″	508	1	24″	610	35″	889	91½″	2324	155	70.3
FN2860-3-24-14/3 *	28″	711	20″	508	2	24″	610	35″	889	114″	2896	180	81.6
FN2860-3-30R or ***L-14/3 ****	28″	711	20″	508	1	30″	762	35″	889	97½″	2477	160	72.6
FN2860-3-30-14/3 *	28″	711	20″	508	2	30″	762	35″	889	126″	3200	190	86.2
FN2860-3-36R or ***L-14/3 ****	28″	711	20″	508	1	36″	914	35″	889	103½″	2629	165	74.8
FN2860-3-36-14/3 *	28″	711	20″	508	2	36″	914	35″	889	138″	3505	200	90.7

* Features two sets of faucet holes.

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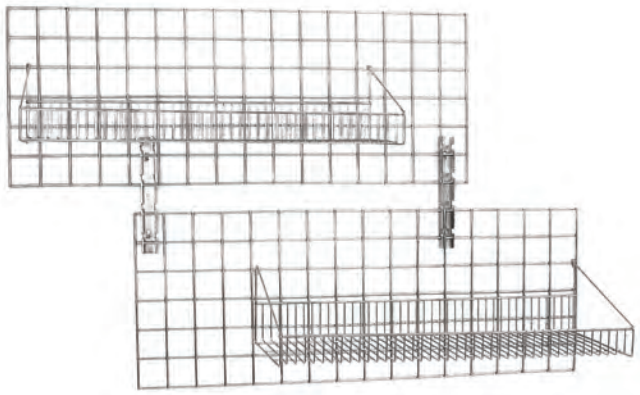
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Wall Grid Shelving for Walstor® Modular Wall System

MODELS:

❑ *1430WGS-C*	❑ *1430WGS-VG*	❑ *1430WGS-Z*
❑ *1436WGS-C*	❑ *1436WGS-VG*	❑ *1436WGS-Z*
❑ *1830WGS-C*	❑ *1830WGS-VG*	❑ *1830WGS-Z*
❑ *1836WGS-C*	❑ *1836WGS-VG*	❑ *1836WGS-Z*
❑ *1848WGS-C*	❑ *1848WGS-VG*	❑ *1848WGS-Z*

See spec sheet #**EG02.00A** for Wall Modular Wall System.
See spec sheet #**EG02.00B** for Walstor® accessories.



wall grid shelves shown attached to Walstor® wall mats

Design and Construction Features

- Provides convenient wire shelving that hooks anywhere onto wall mat of Walstor® Wall System, without fasteners.
- Features built-in 2¾″ (70mm)-high front ledge and 3⅞″ (98mm)-high rear upturn.
- Shelf and brackets welded into one piece.
- Comes in widths of 14″ or 18″ (356 or 457mm), and lengths of 30″, 36″, or 48″ (762, 914, or 1219mm).
- Offered with chrome, Valu-Gard® green epoxy, or EAGLEbrite® zinc finish.

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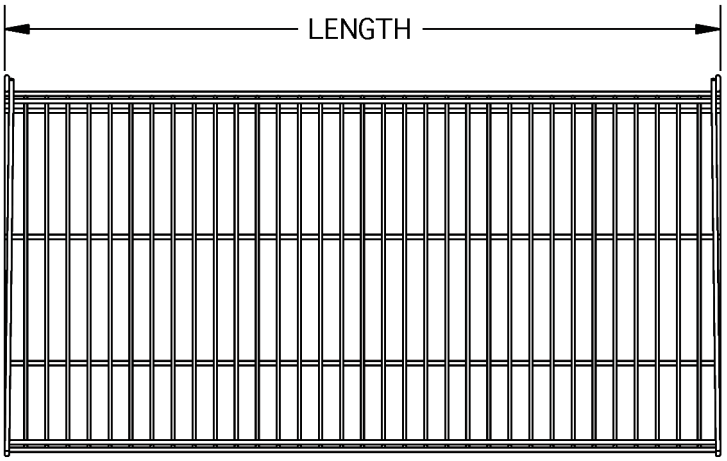
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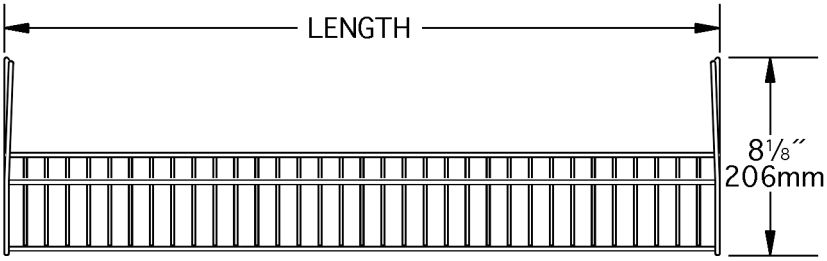
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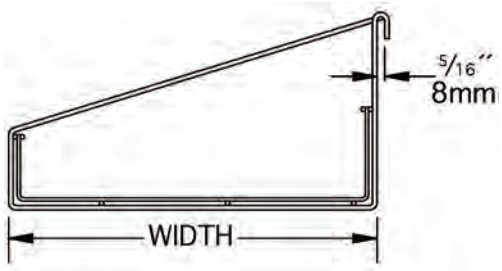
Wall Grid Shelving for Walstor® Modular Wall System



TOP VIEW



FRONT VIEW



SIDE VIEW

CHROME model #	VALU-GARD® model #	EAGLEBRITE® model #	width in.	width mm	length in.	length mm	weight lbs.	weight kg
1430WGS-C	*1430WGS-VG*	*1430WGS-Z*	14″	356	30″	762	7	3.2
1436WGS-C	*1436WGS-VG*	*1436WGS-Z*	14″	356	36″	914	9	4.1
1830WGS-C	*1830WGS-VG*	*1830WGS-Z*	18″	457	30″	762	9	4.1
1836WGS-C	*1836WGS-VG*	*1836WGS-Z*	18″	457	36″	914	12	5.4
1848WGS-C	*1848WGS-VG*	*1848WGS-Z*	18″	457	48″	1219	15	6.8

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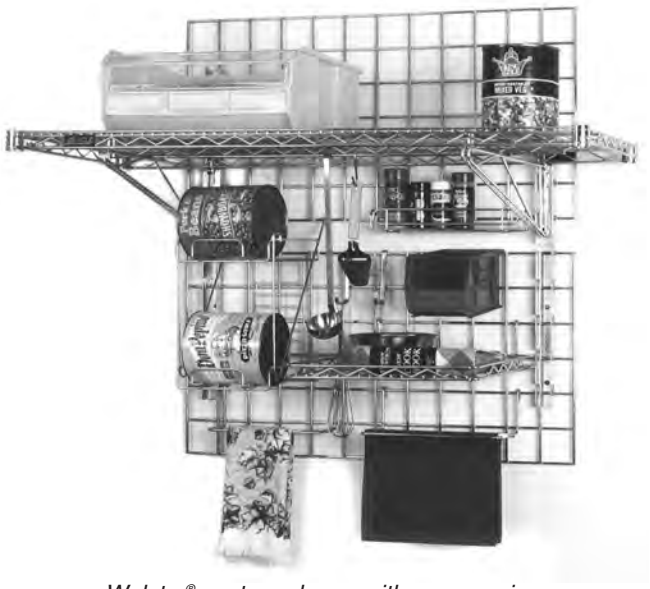
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Specification Sheet



Walstor® system shown with accessories

Walstor® Modular Wall System Accessories

MODELS:

❑ *PH3RD*	❑ *MDH-4*	❑ *SR24*
❑ *BH-1*	❑ *MDH-6*	❑ *TR10*
❑ *DSS*	❑ *MDH-8*	❑ *UH*
❑ *DB*	❑ *MDH-10*	❑ *WB*
❑ *GS17*	❑ *MDH-12*	❑ *CR2D*
❑ *HFH*	❑ *A204237*	❑ *CR4D*
❑ *LDH*	❑ *PBH*	❑ *GPWB*
❑ *A203879*	❑ *A203877*	❑ *GPS24-C*
❑ *LH*	❑ *SH*	❑ *GBP15-C*
❑ *LDUS12*	❑ *SR14*	

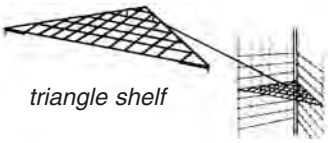
See #**EG02.00A** for Walstor® Modular Wall Systems.
See #**EG02.00C** for Optional Wall Grid Shelving for Walstor®.



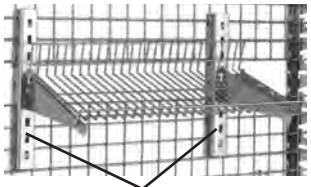
grid shelf



light duty utility shelf



triangle shelf



vertical uprights for display shelf

SHELVES model #	description	weight lbs.	weight kg	length x width x height in.	length x width x height mm
GS17	grid shelf	4.0	1.8	16¾″ x 16¾″	426 x 426
LDUS12	light duty utility shelf	2.0	0.9	11¼″ x 8″ x 3½″	286 x 203 x 89
GPS24-C	triangle shelf	3.6	1.6	24″ x 24″	610 x 610
MISCELLANEOUS					
DSS	vertical uprights	2.0	0.9	2″ x 8¾″	305 x 222
GPWB	wall bracket	0.2	0.1	3″ x 4″ x 4″	76 x 102 x 102

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EG02.00B Catalog Specification Sheet No. Walstor® Modular Wall System Accessories

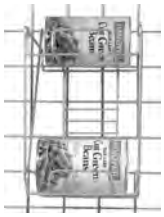
Walstor® Modular Wall System Accessories


large double hook


large snap hook


merchandising display hook


rack


can rack (2-deck)


one-third size pan holder


book holder


hanging file holder


large bin


drop basket

HOOKS AND BRACKETS *		weight		length x width x height	
model #	description	lbs.	kg	in.	mm
LDH	large double hook	0.3	0.1	2¼″ x 4¼″ x ⅜″	57 x 108 x 3
LH	large snap hook	0.3	0.1	2¼″ x 4¼″ x ⅜″	57 x 108 x 3
MDH-4	merchandise display hook	0.2	0.1	4″ x 3″	102 x 76
MDH-6	merchandise display hook	0.2	0.1	6″ x 3″	152 x 76
MDH-8	merchandise display hook	0.2	0.1	8″ x 3″	203 x 76
MDH-10	merchandise display hook	0.2	0.1	10″ x 3″	254 x 76
MDH-12	merchandise display hook	0.2	0.1	12″ x 3″	305 x 76
SH	small snap hook	0.3	0.1	1¼″ x 4¼″ x ⅜″	32 x 108 x 3
UH	utensil hook	0.3	0.1	2½″ x 2″	64 x 51
RACKS					
SR14	rack	1.0	0.5	14″ x 2″	356 x 51
SR24	rack	1.5	0.7	24″ x 2″	610 x 51
TR10	towel rack	1.0	0.5	10½″ x 5″ x 3½″	267 x 127 x 89
CR2D	2-deck can rack	1.0	0.5	8⅝″ x 13″ x 14″	219 x 330 x 356
CR4D	4-deck can rack	3.0	1.3	8¼″ x 8½″ x 28½″	210 x 216 x 724
HOLDERS					
PH3RD	one-third size pan holder	1.0	0.5	12″ x 8″ x 3″	305 x 203 x 76
BH-1	book holder	2.0	0.9	3″ x 12″ x 10″	76 x 305 x 254
HFH	hanging file holder	1.0	0.5	12″ x 8″ x 3″	305 x 203 x 76
PBH	plastic bin holder	0.3	0.1	4″ x 2″	102 x 51
BINS AND BIN ACCESSORIES					
A203877 **	small plastic bin	1.0	0.5	10⅞″ x 5½″ x 5″	276 x 140 x 89
A203879 **	large plastic bin	1.0	0.5	10⅞″ x 11″ x 5″	276 x 280 x 89
A204237	plastic bin dividers	2.0	0.9	10⅞″ x 5″	276 x 89
BASKETS					
DB	drop basket (for 18″ wire shelf)	3.0	1.4	22″ x 18″ x 11″	559 x 457 x 280
WB	wire basket	0.5	0.2	13⅜″ x 5″ x 7″	340 x 127 x 178
GBP15-C	grid panel basket	2.8	1.2	15″ x 24″	381 x 610

* All hooks are heavy gauge chrome-plated mild steel.
** #A203877 and #A203879 bins require #PBH plastic bin holder.

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METRO®

We put space to work.®

Item # _____

Job _____

MetroMax® Q Polymer/Wire Shelving Starter and Add-on Units.

Quick-to-adjust, corrosion resistant shelving constructed of removable polymer open grid shelf mats, wire shelf frames, and corner releases. Shelf frames have an epoxy coating over an electroplated substrate and lift-off plastic shelf mats. Shelves offer a 20 year warranty against corrosion. Rust proof polymer posts offer a lifetime warranty against corrosion. Shelf mats and posts have built-in Microban® antimicrobial product protection. Rigid four-sided shelf frame and welded corners provide complete 360° capture of the wedge and post to ensure stability, strength and structural integrity. Each Starter and Add-on unit has a maximum capacity of 2,000 lbs. (907kg) evenly distributed. Units assemble easily — Shelves mount on four one-piece wedges along grooved, numbered posts. Shelves adjust on 1" (25mm) increments.



Four Shelf Starter Unit

- **Starter units:** shelves and polymer posts under one easy to order model number.
- **Add-on units:** include (2) polymer posts, open grid mat shelves, and S-hooks to connect a unit end-to-end under one easy to order model number.
- **Corner (Right Angle) units:** allow easy access to the shelf contents by eliminating a front post. They are configured using a starter unit, an add-on unit and intermediate "S" hook brackets.
- **Forever Strong:** Proven corner connection and four-sided shelf frame with center truss(es) assures stability and strength in stationary, mobile, and high-density track shelving configurations. 800 lbs. (363kg) per shelf for lengths of 24" to 48" (610 to 1219mm) 600 lbs. (272kg) per shelf for lengths of 54" (1372mm) or longer Stationary unit: 2000lbs (907kg) evenly distributed.
- **Life-Long Rust Resistant:** Shelves offer a 20 year warranty against rust and corrosion. Polymer posts are rust-proof.
- **Easy to Clean and Maintain:** Polymer mats can be easily removed and cleaned in a sink or commercial washer / dish machine.
- **Microban® Antimicrobial Product Protection:** is built into the shelf mats and posts to inhibit the growth of bacteria, mold, mildew, and fungus that cause odors and product degradation. Microban product protection keeps the product "cleaner between cleanings".
- **Quick-to-Adjust:** Patented corner release allows shelves to be adjusted without tools. Simply flip each corner release, relocate the wedge connectors on the posts, and reposition the shelf. Quickly adjust shelves to reclaim wasted vertical space.
- **Efficient Use of Space:** Shelves adjust on 1" (25mm) increments along the post to maximize the use of available vertical space.
- **Fast, Easy Assembly:** Shelves are ready to use right out of the box. One-piece wedges securely attach to the posts – Raised beads on the back of each wedge snap into the grooves on the post. Window on wedge aligns with numbers on the post to locate the desired shelf position. Shelf seats into position over the posts and wedges. A unit can be assembled without tools in minutes.
- **Open Grid (vented) Shelf mats:** Sectioned and promote air circulation and light penetration. Built-in ship's edge helps contain supplies.
- **NSF Listed for all environments.**
- **Maximum Versatility:** Complete line of accessories are found on spec sheet 9.25.



Starter Unit ***Add-on Unit***

NSF | CLEAN DESIGN | Supports good HACCP processes | MICROBAN PROTECTION THAT LIVES ON

MICROBAN® and the MICROBAN® symbol are registered trademarks of the Microban® Products Company, Huntersville, NC. Microban® product protection does not by itself protect a user from food borne illness. Product must be routinely cleaned.

L02-202 Printed in U.S.A. 3/20

METRO®

InterMetro Industries Corporation
North Washington Street, Wilkes-Barre, PA 18705

Product Information. U.S. and Canada: 1.800.992.1776
Outside U.S. and Canada: www.metro.com/contactus

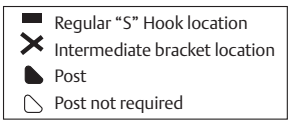
Information and specifications are subject to change without notice. Please confirm at time of order.

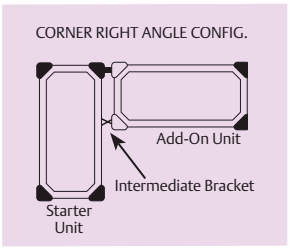
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MetroMax® Q Starter & Add-on Units

Material Specifications:

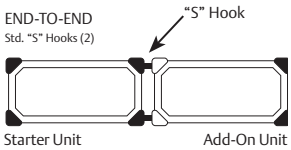
- Shelf Mats: Injection-molded polypropylene with exclusive built-in Microban® antimicrobial product protection.
- Shelf frames and epoxy-coated posts: Steel with electroplated substrate and highly durable, abrasion-resistant epoxy finish. The adjustable foot is reinforced nylon.
- Polymer Post: Pultrusions — continuous glass fibers and thermoset resin composite with built-in Microban® antimicrobial product protection.
- Shelf Wedge Connector: Reinforced nylon.
- Temperature range: -20°F (-29°C) to 125°F (52°C) continuous use, with intermittent exposure to 200°F (93°C) for cleaning.
- Visit metro.com/service-support for cleaning guidelines.





Starter Units: consist of four or five open grid shelves and four posts.

Add-on Units: consist of four or five shelves, (2) posts, and standard S-Hook Kits (2 per shelf) to configure end-to-end units.
Four tier units include (8) standard "S" Hooks. (model number, M9995)
Five tier units include (10) standard "S" Hooks. (model number, M9995)



Corner (Right Angle) Configurations: select one add-on unit and intermediate "S" Hook brackets.

5-Shelf Unit with 74" polymer posts

Starter Units

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Starter Unit
18x24	457x610	39.8	18.1	5Q317G3
18x30	457x760	48.8	22.1	5Q327G3
18x36	457x914	57.3	26.0	5Q337G3
18x42	457x1060	65.8	29.8	5Q347G3
18x48	457x1219	74.8	33.9	5Q357G3
18x54	457x1372			
18x60	457x1524	92.3	41.9	5Q367G3
18x72	457x1829	108.8	49.4	5Q377G3
21x24	530x610	48.8	22.1	5Q417G3
21x30	530x760	57.3	26.0	5Q427G3
21x36	530x914	65.8	29.8	5Q437G3
21x42	530x1060	72.8	33.0	5Q447G3
21x48	530x1219	81.3	36.9	5Q457G3
21x54	530x1372			
21x60	530x1524	101.3	45.9	5Q467G3
21x72	530x1829	117.3	53.2	5Q477G3
24x24	610x610	57.3	26.0	5Q517G3
24x30	610x760	65.8	29.8	5Q527G3
24x36	610x914	74.3	33.7	5Q537G3
24x42	610x1060	79.3	36.0	5Q547G3
24x48	610x1219	87.8	39.8	5Q557G3
24x54	610x1372			
24x60	610x1524	110.3	50.0	5Q567G3
24x72	610x1829	126.3	57.3	5Q577G3

Add-On Units

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Add-On Unit
18x24	457x610	37.4	17.0	5AQ317G3
18x30	457x760	46.4	21.0	5AQ327G3
18x36	457x914	54.9	24.9	5AQ337G3
18x42	457x1060	63.4	28.8	5AQ347G3
18x48	457x1219	72.4	32.8	5AQ357G3
18x54	457x1372			
18x60	457x1524	89.9	40.8	5AQ367G3
18x72	457x1829	106.4	48.3	5AQ377G3
21x24	530x610	46.4	21.0	5AQ417G3
21x30	530x760	54.9	24.9	5AQ427G3
21x36	530x914	63.4	28.8	5AQ437G3
21x42	530x1060	70.4	31.9	5AQ447G3
21x48	530x1219	78.9	35.8	5AQ457G3
21x54	530x1372			
21x60	530x1524	98.9	44.9	5AQ467G3
21x72	530x1829	114.9	52.1	5AQ477G3
24x24	610x610	54.9	24.9	5AQ517G3
24x30	610x760	63.4	28.8	5AQ527G3
24x36	610x914	71.9	32.6	5AQ537G3
24x42	610x1060	76.9	34.9	5AQ547G3
24x48	610x1219	85.4	38.7	5AQ557G3
24x54	610x1372			
24x60	610x1524	107.9	48.9	5AQ567G3
24x72	610x1829	123.9	56.2	5AQ577G3

Actual Dimensions:
Width: Add 3/8" (10mm) to nominal size. Length: Subtract 3/16" (5mm) from nominal size.



74" Five Shelf Starter Unit



Starter & Add-on Unit Together



"S" Hook
Cat. No. **M9995**



Intermediate"S" Hook Kit
Cat. No. **Q9995Z**

Creating a Right Angle (Corner) configuration. Use one standard "S" Hook (included with the Add-on unit) and one Intermediate "S" Hook per tier. Intermediate"S" Hook Bracket Cat. No. Q9995Z

Job _____

MetroMax® Q Starter & Add-on Units

We put space to work.

4-Shelf Unit with 74" polymer posts

Starter Units

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Starter Unit
18x24	457x610	33.6	15.2	MQ-182474G-S-4
18x30	457x760	40.8	18.5	MQ-183074G-S-4
18x36	457x914	47.6	21.6	MQ-183674G-S-4
18x42	457x1060	54.4	24.7	MQ-184274G-S-4
18x48	457x1219	61.6	27.9	MQ-184874G-S-4
18x54	457x1372	68.8	31.2	MQ-185474G-S-4
18x60	457x1524	75.6	34.3	MQ-186074G-S-4
18x72	457x1829	88.8	40.3	MQ-187274G-S-4
21x24	530x610	40.8	18.5	MQ-212474G-S-4
21x30	530x760	47.6	21.6	MQ-213074G-S-4
21x36	530x914	54.4	24.7	MQ-213674G-S-4
21x42	530x1060	60.0	27.2	MQ-214274G-S-4
21x48	530x1219	66.8	30.3	MQ-214874G-S-4
21x54	530x1372	75.6	34.3	MQ-215474G-S-4
21x60	530x1524	82.8	37.6	MQ-216074G-S-4
21x72	530x1829	95.6	43.4	MQ-217274G-S-4
24x24	610x610	47.6	21.6	MQ-242474G-S-4
24x30	610x760	54.4	24.7	MQ-243074G-S-4
24x36	610x914	61.2	27.8	MQ-243674G-S-4
24x42	610x1060	65.2	29.6	MQ-244274G-S-4
24x48	610x1219	72.0	32.7	MQ-244874G-S-4
24x54	610x1372	82.8	37.6	MQ-245474G-S-4
24x60	610x1524	90.0	40.8	MQ-246074G-S-4
24x72	610x1829	102.8	46.6	MQ-247274G-S-4

Add-On Units

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Add-On Unit
18x24	457x610	30.8	14.0	MQ-182474G-A-4
18x30	457x760	38.0	17.2	MQ-183074G-A-4
18x36	457x914	44.8	20.3	MQ-183674G-A-4
18x42	457x1060	51.6	23.4	MQ-184274G-A-4
18x48	457x1219	58.8	26.7	MQ-184874G-A-4
18x54	457x1372	66.0	29.9	MQ-185474G-A-4
18x60	457x1524	72.8	33.0	MQ-186074G-A-4
18x72	457x1829	86.0	39.0	MQ-187274G-A-4
21x24	530x610	38.0	17.2	MQ-212474G-A-4
21x30	530x760	44.8	20.3	MQ-213074G-A-4
21x36	530x914	51.6	23.4	MQ-213674G-A-4
21x42	530x1060	57.2	25.9	MQ-214274G-A-4
21x48	530x1219	64.0	29.0	MQ-214874G-A-4
21x54	530x1372	72.8	33.0	MQ-215474G-A-4
21x60	530x1524	80.0	36.3	MQ-216074G-A-4
21x72	530x1829	92.8	42.1	MQ-217274G-A-4
24x24	610x610	44.8	20.3	MQ-242474G-A-4
24x30	610x760	51.6	23.4	MQ-243074G-A-4
24x36	610x914	58.4	26.5	MQ-243674G-A-4
24x42	610x1060	62.4	28.3	MQ-244274G-A-4
24x48	610x1219	69.2	31.4	MQ-244874G-A-4
24x54	610x1372	80.0	36.3	MQ-245474G-A-4
24x60	610x1524	87.2	39.6	MQ-246074G-A-4
24x72	610x1829	95.6	43.4	MQ-247274G-A-4



4-Shelf Starter Unit

4-Shelf Unit with 63" polymer posts

Starter Units

Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Starter Unit
18x24	457x610	32.0	14.5	Q316G3
18x30	457x760	39.2	17.8	Q326G3
18x36	457x914	46.0	20.9	Q336G3
18x42	457x1060	52.8	23.9	Q346G3
18x48	457x1219	60.0	27.2	Q356G3
18x54	457x1372			
18x60	457x1524	74.0	33.6	Q366G3
18x72	457x1829	87.2	39.6	Q376G3
21x24	530x610	39.2	17.8	Q416G3
21x30	530x760	46.0	20.9	Q426G3
21x36	530x914	52.8	23.9	Q436G3
21x42	530x1060	58.4	26.5	Q446G3
21x48	530x1219	65.2	29.6	Q456G3
21x54	530x1372			
21x60	530x1524	81.2	36.8	Q466G3
21x72	530x1829	94.0	42.6	Q476G3
24x24	610x610	46.0	20.9	Q516G3
24x30	610x760	52.8	23.9	Q526G3
24x36	610x914	59.6	27.0	Q536G3
24x42	610x1060	63.6	28.8	Q546G3
24x48	610x1219	70.4	31.9	Q556G3
24x54	610x1372			
24x60	610x1524	88.4	40.1	Q566G3
24x72	610x1829	101.2	45.9	Q576G3

Add-On Units

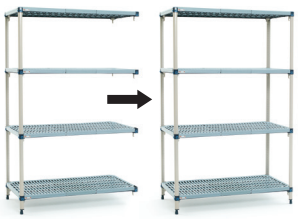
Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Cat. No. Add-On Unit
18x24	457x610	30.0	13.6	AQ316G3
18x30	457x760	37.2	16.9	AQ326G3
18x36	457x914	44.0	20.0	AQ336G3
18x42	457x1060	50.8	23.0	AQ346G3
18x48	457x1219	58.0	26.3	AQ356G3
18x54	457x1372			
18x60	457x1524	72.0	32.7	AQ366G3
18x72	457x1829	85.2	38.6	AQ376G3
21x24	530x610	37.2	16.9	AQ416G3
21x30	530x760	44.0	20.0	AQ426G3
21x36	530x914	50.8	23.0	AQ436G3
21x42	530x1060	56.4	25.6	AQ446G3
21x48	530x1219	63.2	28.7	AQ456G3
21x54	530x1372			
21x60	530x1524	79.2	35.9	AQ466G3
21x72	530x1829	92.0	41.7	AQ476G3
24x24	610x610	44.0	20.0	AQ516G3
24x30	610x760	50.8	23.0	AQ526G3
24x36	610x914	57.6	26.1	AQ536G3
24x42	610x1060	61.6	27.9	AQ546G3
24x48	610x1219	68.4	31.0	AQ556G3
24x54	610x1372			
24x60	610x1524	86.4	39.2	AQ566G3
24x72	610x1829	99.2	45.0	AQ576G3



4-Shelf Add-On Unit



Includes 8 S-Hooks



Add-on mounts to starter unit via S-Hooks.

Actual Dimensions:
Width: Add 3/8" (10mm) to nominal size. Length: Subtract 3/16" (5mm) from nominal size.

CRES COR®

JOB: _____

ITEM NO: _____

INSULATED STAINLESS STEEL SUPER DUTY HOT CABINET SERIES

FEATURES AND BENEFITS:

- Fully insulated hot cabinet keeps prepared foods at safe serving temperatures.
- Available in Full Size, 3/4 Size or half size units with locking universal transport angles accommodate a variety of pan sizes on adjustable 1-1/2" centers.
- Powerful, yet efficient, 1500 Watt heating system maintains the right temperature to properly hold products. Heats up to 200˚F (93˚C).
- Standard solid state electronic control with large, clear, easy-to-read and operate LED digital display to ensure holding at precise food temperature.
- Internal frame in body maintains structural rigidity.
- Full perimeter bumper, rear push/pull handle and dry erase panel come standard on all models.
- Stainless steel construction throughout for ease of cleaning. One piece extended base protects cabinet body.
- Super duty composite side impact panel protection with ergonomic grips on both sides prevents damage to walls; allows for easy maneuvering.
- Insulated Dutch doors prevent temperature loss. Standard with right hand hinging; left hand hinging available upon request.
- Lockable slide bolt door latches ensure the doors stay closed even during the roughest transport.
- Smooth interior coved corners prevent food particle/grease buildup.
- Heavy duty 6" modulus casters, two with brakes. Provides mobility when fully loaded.



H-137-SUA-12D-SD



Standard solid state electronic control with large, clear, easy-to-read and operate LED digital display to ensure holding at precise food temperature

ACCESSORIES and OPTIONS (Available at extra cost):

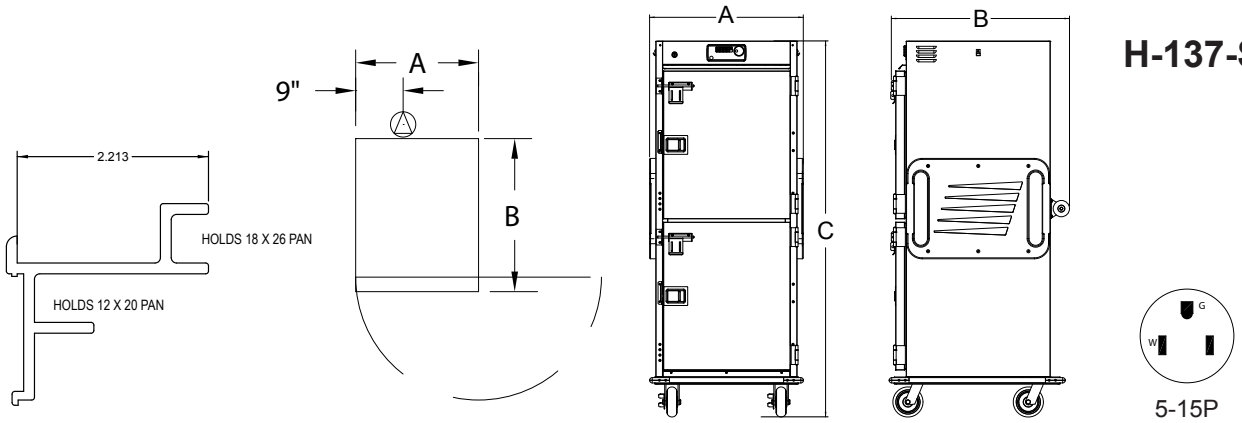
- ❑ Extra Transport Angles
- ❑ 208 or 240 Volt Service
- ❑ Upgrade to 2000 Watt Power Unit

See page B-20 for accessory details.

CRES COR®
5925 Heisley Road • Mentor, OH 44060-1833
Phone: 877/CRESCOR • Fax: 440/350-7267
www.crescor.com

GOLD

Gold indicates our Best Insulated Hot Cabinets with the best warranty in the industry.
3-Year Parts / 1-Year Labor.



H-137-SD SERIES

CRES COR MODEL NO.	PAN			DIM "A"	DIM "B"	DIM "C"	INSIDE DIMENSIONS				WEIGHT ACT.
	CAP/ ANGLES	SIZE		WIDTH	DEPTH	HEIGHT	WIDTH	DEPTH	HEIGHT		
H-137-SUA-12D-SD	12 SETS	SEE NOTE BELOW	IN	30-1/2	34-7/8	74-3/8	22	26-7/8	58	LBS	283
			MM	775	885	1890	560	685	1475	KG	128
H-137-SUA-9D-SD	9 SETS	SEE NOTE BELOW	IN	30-1/2	34-7/8	58-5/8	22	26-7/8	42	LBS	295
			MM	775	885	1490	560	685	1070	KG	134
H-137-SUA-6D-SD	6 SETS	SEE NOTE BELOW	IN	30-1/2	34-7/8	44-3/8	22	26-7/8	28	LBS	280
			MM	775	885	1130	560	685	715	KG	127

NOTE: Pan sizes 18" x 26" (460 x 660) Bun Pans, 12" x 20" (305 x 510) Steam Table Pans.

GOLD

Gold indicates our Best Insulated Hot Cabinets with the best warranty in the industry.
3-Year Parts / 1-Year Labor.

CABINET:

- Body: 22 ga. stainless steel.
- Reinforcement: Internal framework of 18 ga. 304 stainless steel.
- Insulation: Fiberglass, thermal conductivity (K factor) is .23 at 75˚F. 1-1/2" in doors, base top; 2" in sidewalls.
- Air tunnels: 22 ga. stainless steel; lift-out type, mounted on sides.
- Push/pull handle: Welded stainless steel with end bumpers; rear mounted.
- Interior coved corners.
- Super Duty composite side impact panel with ergonomic grips.
- Supplied with magnetic white erasable board, 12" x 12".

BASE:

- One piece construction, .125 aluminum; extended in rear for toe kick.
- Casters: 6" dia., modulus tires, 2" wide, load cap. 450 lbs. each, temp. range -40˚/+180˚F. Sealed ball bearings; permanently lubricated. Front casters equipped with brakes.
- Perimeter bumper: 1" non-marking gray rubber.

DUTCH DOORS:

- Formed 22 ga. stainless steel.
- Hinges: 11 ga. stainless steel, butt type.
- Gaskets: Perimeter type, silicone.
- Pan stop: Embossed.
- Latches: Polished stainless steel, slam type; flush mounted.
- Transport Latch: 12 ga. stainless steel slide with lockable hasp.

TRANSPORT PAN SLIDES:

- Extruded aluminum; mounted on locking lift-off posts.
- Spaced on 4-1/2" centers; adjustable on 1-1/2" centers.

Scan QR code to view Spec Sheet, Operating Manual, Wiring Diagram or to call Customer Service.

If you need a QR reader visit your App Store on your Smartphone or Tablet.

HOT UNIT COMPONENTS:

- Thermostat: Solid state digital display control, room ambient to 200˚F (93˚C).
- Switch: ON-OFF push button type.
- Power cord: Permanent, 10 ft., 14/3 ga.
- Heater: 1470 Watts (960 Watts for -UA6D)
- Blower motor.
- Vent Fan.
- Thermometer: Digital.

POWER REQUIREMENTS:

- For H137SUA9D and H137SUA12D: 1500 Watts, 120 Volts, 60 Hz., single phase, 12 Amps., 15 Amp. service.
- For H137SUA6D: 1000 Watts, 120 Volts, 60 Hz., single phase, 8.3 Amps., 15 Amp. service.

SHORT FORM SPECIFICATIONS

Cres Cor Insulated Hot Cabinet Model H-137-SUA-___D. Solid state electronic controlled time and temperatures. Cabinet 22 ga. stainless steel; stainless steel internal frame. (__) sets locking transport angles for multiple pan sizes, adjustable spacing every 1-1/2". Dutch doors, 22 ga. stainless steel. Fiberglass insulation in sides, 2"; doors, base, top 1-1/2". Interior coved corners. 1500 or 1000 Watt, 120 Volt power unit. One piece insulated base, .125 aluminum. 6" modulus casters, ball bearings. Load capacity 450 lbs. each. 3-Year Parts / 1-Year Labor warranty. Provide the following accessories: ____ ____ ____ . NSF, CSA-US, CSA-C listed. Energy Star Qualified.

CRES COR®
5925 Heisley Road • Mentor, OH 44060-1833
Phone: 877/CRESCOR • Fax: 440/350-7267
www.crescor.com

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In line with its policy to continually improve its products, CRES COR reserves the right to change materials and specifications without notice.

Litho in U.S.A.

CRES COR®

JOB: _____

ITEM NO: _____

SUPER DUTY
CHILLTEMP® REFRIGERATED CABINET
MODEL R-171-SUA-10E-SD



R-171-SUA-10E-SD

FEATURES AND BENEFITS:

- Super duty composite side impact panel protection with ergonomic grips on both sides prevents damage to walls; allows for easy maneuvering.
- Fully insulated mobile ChillTemp® refrigerated cabinet for holding food and beverages at serving temperature.
- Lockable slide bolt door latches ensure the doors stay closed even during the roughest transport.
- Forced air system provides even distribution of cold air; cabinet maintains temperatures from 33˚F (.5˚ C) to 40˚F (4.5˚ C). Automatically defrosts.
- 1/3 horsepower compressor with automatic overload reset. R134a refrigerant for environmental compatibility.
- Full perimeter bumper, rear push/pull handle and dry erase panel come standard on all models.
- Stainless steel construction throughout for ease of cleaning. One piece extended base protects cabinet body.
- Self-closing insulated door prevents temperature loss. Magnetic door gaskets for proper seal.
- Insulated door prevents temperature loss. Standard with right hand hinging; left hand hinging available upon request.
- Generous 18-cubic foot interior.
- Ten sets of chrome plated wire angles accommodate a large variety of pan sizes on adjustable 1-1/2" centers.
- Heavy duty 6" modulus casters, two with brakes. Provides mobility when fully loaded.

C US

SANITATION NSF/ANSI 7

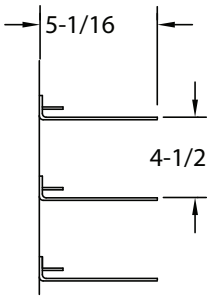
ACCESSORIES and OPTIONS (Available at extra cost):

- ❑ Menu Card Holder
- ❑ Corner Bumpers
- ❑ Polyurethane Casters
- ❑ 240 Volt Service
- ❑ Digital Thermometer
- ❑ Interior for (28) 18" x 26" pans

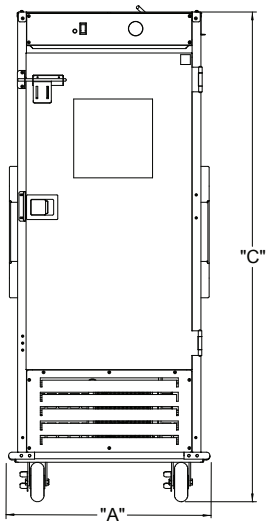
See page K-4 for accessory details.

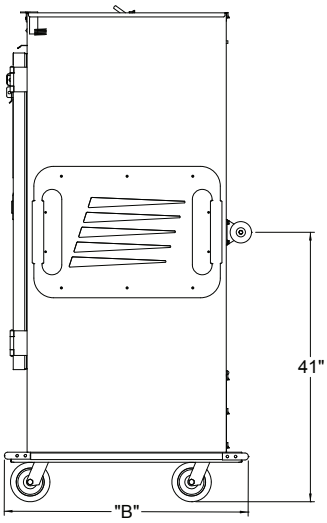
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5925 Heisley Road • Mentor, OH 44060-1833
Phone: 877/CRESCOR • Fax: 440/350-7267
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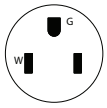
R-171-SUA-10E-SD



DETAIL OF PAN SLIDE







5-15 P

CRES COR MODEL NO.	PAN			DIM "A"	DIM "B"	DIM "C"	INSIDE DIMENSIONS				WEIGHT ACT.
	CAP/ ANGLES	SIZE		WIDTH	DEPTH	HEIGHT	WIDTH	DEPTH	HEIGHT		
R-171-SUA-10E-SD	10 SETS	18 X 26	IN	30-7/16	40-1/2	77-1/8	23-1/2	29-3/4	47-3/8	LBS	408
			MM	773	1029	1959	597	755	1203	KG	186
	20 SETS	12 X 20	IN								
			MM								

CABINET:
- Body: 22 ga. stainless steel.
- Reinforcement: Internal framework of 18 ga. 304 stainless steel.
- Insulation: Fiberglass, thermal conductivity (K factor) is .23 at 75˚F. 1-1/2" in doors, base top; 2" in sidewalls.
- Push/pull handle: Welded stainless steel with end bumpers; rear mounted.
- Interior coved corners.
- Super Duty composite side impact panel with ergonomic grips.
- Supplied with magnetic white erasable board, 12" x 12".

BASE:
- One piece construction, .125 aluminum; extended in rear for toe kick.
- Casters: 6" dia., modulus tires, 2" wide, load cap. 450 lbs. each, temp. range -40˚/+180˚F. Sealed ball bearings; permanently lubricated. Front casters equipped with brakes.
- Perimeter bumper: 1" non-marking gray rubber.

DOOR:
- Formed 22 ga. stainless steel.
- Hinges: 11 ga. stainless steel, butt type.
- Gasket: Perimeter type, silicone.
- Pan stop: Embossed.
- Latch: Polished stainless steel, slam type; flush mounted.
- Transport Latch: 12 ga. stainless steel slide with lockable hasp.

PAN SLIDES:
- Wire angles (.306 dia.), nickel chrome plated steel, mounted on lift-off posts.
- Spaced on 4-1/2" centers; adjustable on 1-1/2" centers.

ELECTRICAL COMPONENTS:
- Thermostat: Pre-set to 38˚ F (3.3˚ C).
- Pilot light.
- Switch.
- Power cord: Permanent, 10 ft., 14/3 ga. with molded plug.
- Compressor: 1/3 h.p.
- Condensate evaporator: Electrical.
- R134a refrigerant.

POWER REQUIREMENTS:
- 120 Volts, 60 Hz., single phase, 15 Amp. service.

SHORT FORM SPECIFICATIONS

Cres Cor Refrigerated Cabinet Model R-171-SUA-10E-SD. Cabinet 22 ga. stainless steel; stainless steel internal frame. (10) sets of wire universal angles for multiple pan sizes, adjustable spacing every 1-1/2". Door, 22 ga. stainless steel. Foam insulation in sides and doors. Interior coved corners. 1/3 h.p. compressor, 120 Volts. One piece base, .125 aluminum. 6" swivel casters, ball bearings. Load capacity 450 lbs. each. 2-Year Parts / 1-Year Labor warranty. Provide the following accessories: _____ _____ _____. CSA-US/C, CSA to NSF7 listed.

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Phone: 877/CRESCOR • Fax: 440/350-7267
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In line with its policy to continually improve its products, CRES COR reserves the right to change materials and specifications without notice.

Made in America Since 1936

BEVERAGE-AIR

Project: _____	AIA#
Item: _____	
Location: _____	SIS#
Approved:	

SCHOOL MILK COLD WALL COOLER

SM58HC Single Access Cooler
Hydrocarbon Series

MODEL:
SM58HC-S



3 Year Parts/Labor Warranty
Additional 4 Year Compressor Warranty

CABINET CONSTRUCTION

- Stainless steel exterior and interior
- Stainless steel lids, hinges doors and door latches
- Full electronic control
- Heavy-duty epoxy coated steel wire floor racks standard
- Floor drain is centrally located for easy cleaning, connecting to drain hose with hose adapter
- Flexible compression door gaskets ensure tight seal
- Self-latching doors/lids with safety bumpers
- Exterior thermometer
- Cylinder lock
- 4" Heavy-duty plate casters (2 with locks)
- Cold wall milk coolers are designed to hold product temperature during service. Product should be removed at the end of service and moved to long-term, refrigerated storage.

OPTIONS & ACCESSORIES

- Corner bumpers
- Cafeteria tray slide
- Graphics

REFRIGERATION SYSTEM

- Uses environmentally friendly, energy efficient R290 refrigerant, and meets all regulatory requirements for CARB, SNAP, DOE & more
- Maintains product temperature between 36º to 40ºF

SM58HC SINGLE ACCESS, COLD WALL: SCHOOL MILK SERIES

Please verify qualifying units by visiting:
www.energystar.gov/cfs

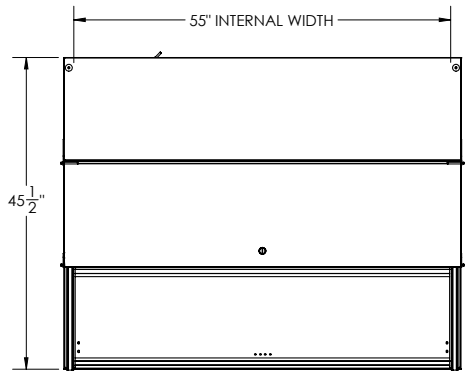
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Beverage-Air.com Sales@bevair.com

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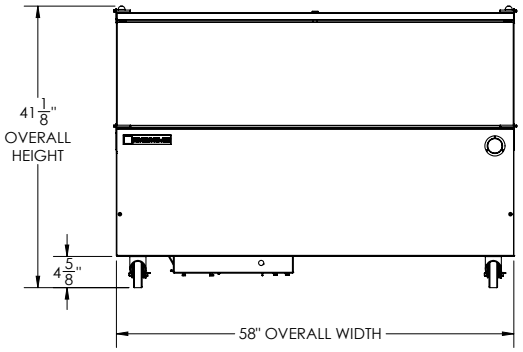
School Milk Cooler - Single Access
Model: SM58HC-S

MODEL	SM58HC-S
EXTERNAL DIMENSIONAL DATA	
Width Overall	58”
Depth Overall	30 ⅝”
Height Overall with Casters	41 ⅛”
Number of Lids/Doors	Single Access
Depth with Door Open 90º	45 ½”
INTERNAL DIMENSIONAL DATA	
NET Capacity (cubic ft.)	22.63
Internal Width Overall (in)	55”
Internal Depth Overall (in)	27”
Internal Height Usable (in)	25 ¾”
CASE CAPACITY	
13” X 13” X 11”	16
19” X 13” X 11”	10
ELECTRICAL DATA	
Full Load Amperes	2.2
REFRIGERATION DATA	
Horsepower	1/3
Capacity (BTU/Hr)	1434
SHIPPING DATA	
Gross Weight	384 lbs
Height - Crated	48”
Width - Crated	61”
Depth - Crated	34”

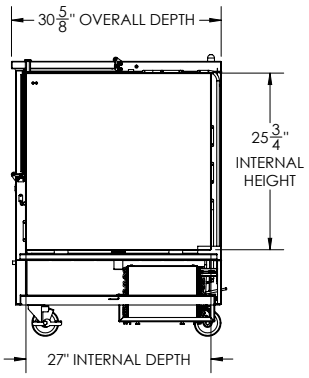
Model Views



PLAN VIEW



ELEVATION VIEW



SIDE VIEW

ELECTRICAL CONNECTION



115/60/1
NEMA 5-15P

Units pre-wired at factory and include 8’ long cord and plug set.

PIPER ELITE 500

Bloomington Cold

Extra Deep Cold Pan - Listed NSF/ANSI Standard 7



3-BCM-SD

The Piper Elite 500 Bloomington mechanically refrigerated, extra deep well unit is listed NSF/ANSI Standard 7. Food is recessed on easily removable rails in the pan for maximum cooling efficiency without the use of ice and is ideal as a salad bar merchandiser. Elite 500 units are compatible and will interlock with other Elite 500 units.

STANDARD FEATURES

- 14-gauge stainless steel top with 1-1/2" turndown on all sides
- Top secured by four recessed bolts for easy access
- 14-gauge stainless steel legs fastened to 18-gauge stainless steel bottom shelf
- 20-gauge stainless steel end and front panels are attached to legs
- 20-gauge stainless steel fully welded 9-7/16" deep well
- Welded watertight well has concealed continuous refrigerated coil bonded to the sides and is fully insulated
- Cold pan has a 1" drain with shut off valve located below the unit on operator's left side. Valve is 3/4" FTP.
- Sliding doors
- Louvered panels for ventilation of condensing unit
- End louver panel removable to access compressor
- 5" diameter swivel plate casters, 2 with brakes
- Interlocking mechanism is provided to interlock with other Elite 500 units

JOB_____ ITEM # _____ QTY # _____

MODEL NUMBER

- ❑ 2-BCM
- ❑ 3-BCM
- ❑ 4-BCM
- ❑ 5-BCM
- ❑ 6-BCM

DIMENSIONS

- 2-BCM - 36"H x 28"D x 32"L
- 3-BCM - 36"H x 28"D x 46"L
- 4-BCM - 36"H x 28"D x 60"L
- 5-BCM - 36"H x 28"D x 74"L
- 6-BCM - 36"H x 28"D x 88"L
- 36" height on all standard units
- 30" height is available on Petite Elite units
- 28" width
- 32" to 88" length in 14" increments
- **Optional: Pizzazz Powder Coating in lieu of Stainless Steel**

NSF/ANSI STANDARD 7

This unit is listed with CSA in NSF/ANSI Standard 7 for design and construction and has been performance tested for the storage of potentially hazardous foods. The performance test criteria is holding a food-like media at or below 41°F without any freezing for four hours at 86°F ambient temperature.

ELECTRICAL

- 120 volts single-phase
- Eight foot electrical cord with NEMA 5-15P plug
- On/Off switch and pilot light mounted on control panel of unit's operator side

REFRIGERATION SYSTEM

- 1/3 horsepower compressor
- Fan-cooled condensing unit with an expansion valve pressure control switch
- Refrigerant coils shall be of copper tubing wrapped around the sides of the well

WARRANTY

- One year parts and labor. Warranty is detailed on inside front cover of the price list.

SPEC A-5

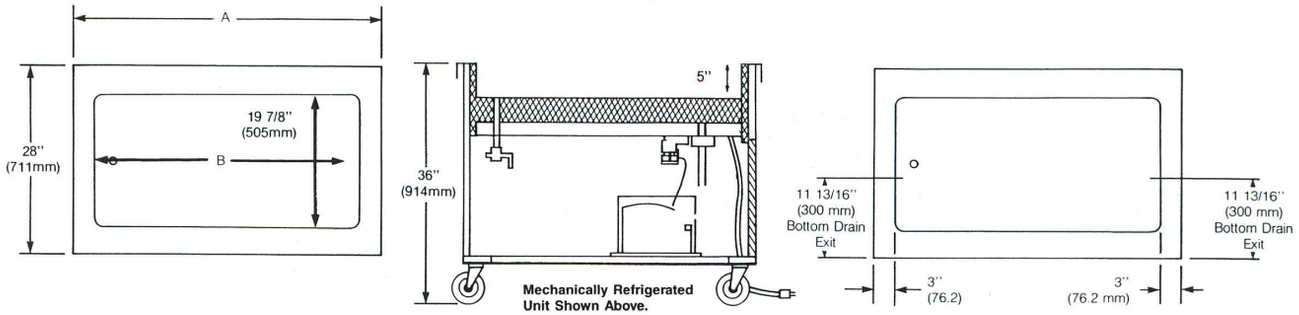
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The Food-Focused Equipment Company
a CFSBRANDS company
www.piperonline.net

300 S. 84th Avenue
Wausau, WI 54401
Phone: 800-544-3057
Fax: 715-842-3125

PIPER ELITE 500

Bloomington Cold

Extra Deep Cold Pan - Listed NSF/ANSI Standard 7



BLOOMINGTON COLD FOOD UNIT SPECIFICATIONS

Model#	*12x20 Pan Capacity	(A)	(B)	Width	Height	*Amperage 120V	*NEMA Cap No.	Ship Wt. (lbs)
2-BCM	2	32”	36.25"	28”	36”	6.3	5-15P	320
3-BCM	3	46”	40.25"	28”	36”	6.3	5-15P	360
4-BCM	4	60”	54.25"	28”	36”	6.3	5-15P	405
5-BCM	5	74”	68.25"	28”	36”	6.3	5-15P	440
6-BCM	6	88”	82.25"	28”	36”	6.3	5-15P	480

*Amperage/NEMA plug type may vary with options.

DIMENSION ADDITIONS FOR OPTIONS

- Add 23-3/4” to height for buffet protector guard
- Add 14” to height for cafeteria protector guard
- Add 22-3/4” to height for double display shelf
- Add 8” to width for cutting board
- Add 12-3/4” to width for solid ribbed tray slide
- Add 12-1/2” to width for 3-bar tray slide

Note: Line-up drawing required when ordering false front, cashier stand or interconnected units.

OPTIONS / ACCESSORIES

	Part #	Description
❑	PPC	Pizzazz Powder Coating
❑	SCB	8” stainless steel cutting board, flush with top
❑	MCB	8” maple cutting board, flush with top
❑	SRTS	Solid 3-ribbed tray slide, 16-gauge stainless steel
❑	3BTS	3-bar tray slide
❑	MBS	18” maple end bread shelf; left, right - flush with top
❑	SBS	18” stainless steel end bread shelf; left, right - flush with top
❑	CPG	Cafeteria protector guard (no heat or lights)
❑	CPGL	Cafeteria protector guard with incandescent lights
❑	CPGFL	Cafeteria protector guard with fluorescent lights
❑	CPGHL	Cafeteria protector guard with heat and lights
❑	CDD	Cafeteria double display (no heat or lights)
❑	CDDL	Cafeteria double display with fluorescent lights
❑	BPG1	Buffet single side protector guard (no heat or lights)
❑	BPG1IL	Buffet single side protector guard with incandescent lights
❑	BPG1FL	Buffet single side protector guard with fluorescent lights
❑	BPG	Buffet double side protector guard (no heat or lights)

	Part #	Description
❑	BPGIL	Buffet double side protector guard with incandescent lights
❑	BPGFL	Buffet double side protector guard with fluorescent lights
❑	BPGH	Buffet double side protector guard with heat strip
❑	BDD	Buffet double display two-sided protector guard
❑	BPGC	Buffet classic two-sided protector guards
❑	CPGC	Cafeteria Style Classic (1-5/8) protector guards
❑	CDDC	Cafeteria Style Classic Double Display protector guards
❑	BPG1C	Buffet Style Classic Single Sided protector guards
❑	SCPGC	Cafeteria Style Classic Single protector guards
❑	SSL	Legs in lieu of casters
❑	DOUT	Duplex outlet (120V, 15 AMP)
❑	FRMAD	Formica laminate finish without doors
❑	CUT	Cut out for drop in dispensers.
❑	UCR-1	Refrigerated storage base with doors - for units 60” or larger
❑	UCR-2	Refrigerated storage base 74” or larger
❑	SKR	Skirting
❑	CEG	Cafeteria end guards, right or left
❑	HD	Hinged doors

A-5 SPEC

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a CFSBRANDS company
www.piperonline.net

300 S. 84th Avenue
Wausau, WI 54401
Phone: 800-544-3057
Fax: 715-842-3125

LIMITED WARRANTY: PIPER PRODUCTS warrants to the original purchaser parts and labor for a period of twelve (12) months from the date of purchase. See manufacturer’s complete warranty for details.

It is our policy to build equipment which is design certified by companies that have been accredited at the Federal Level by the Occupational Safety and Health Agency (OSHA) and ANSI as a National Recognized Testing Laboratory. These companies include CSA International, Underwriters Laboratories, and the National Sanitation Foundation. However, a continuing program of product improvement makes it necessary to submit new models to the agencies as they are developed. Consequently, all models may not bear the appropriate labels at all times.

We reserve the right to change specifications and product design without notice. Such revisions do not entitle buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment. Information is not for design purposes.

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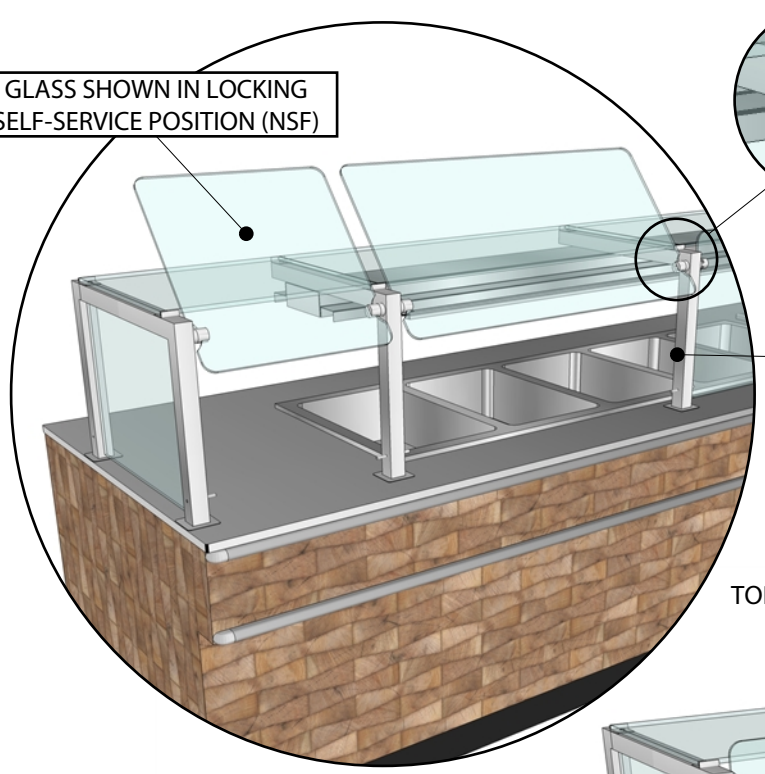
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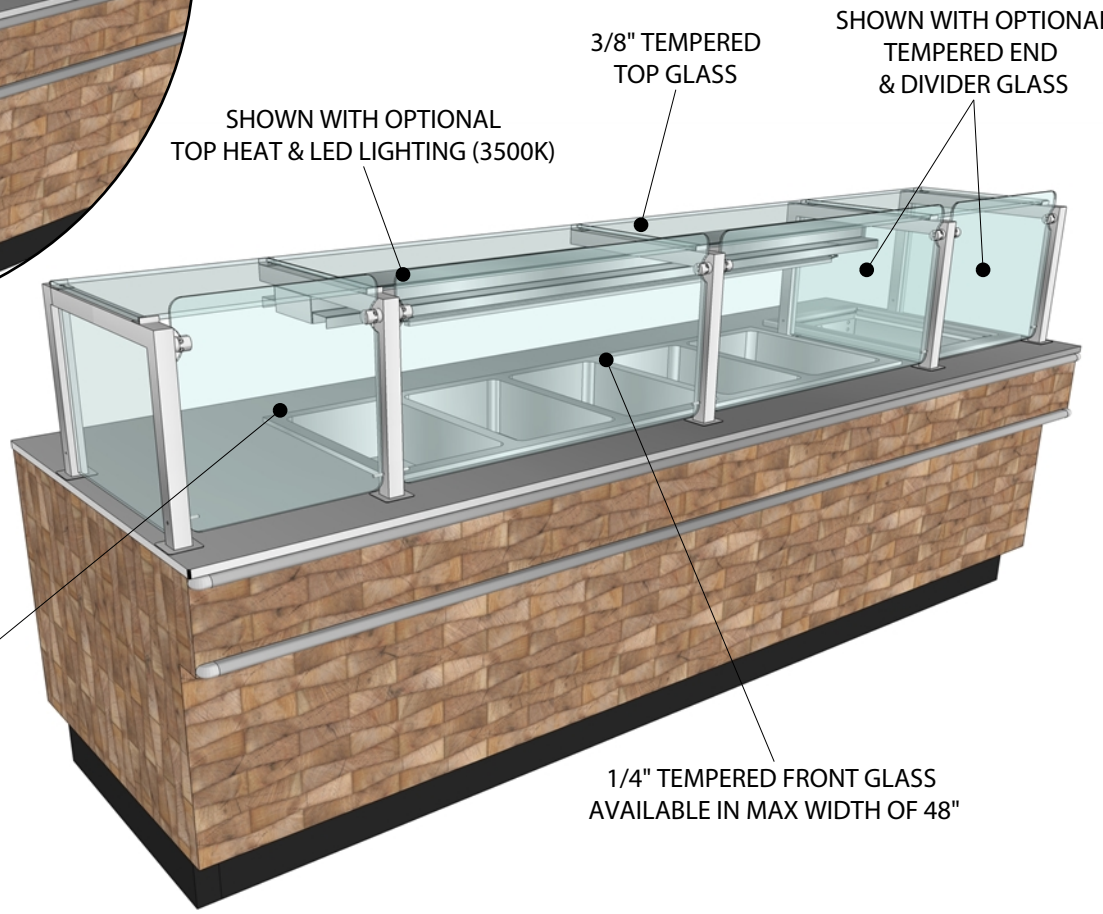
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CONVERTIBLE GUARD SHOWN ON PIPER INLINE HOT/COLD BAR

CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

REF. # 45429-03SIM

REVISIONS	
1	NTE 3/7/2018

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Date: 1-31-2018

Sheet No.
1 of 5

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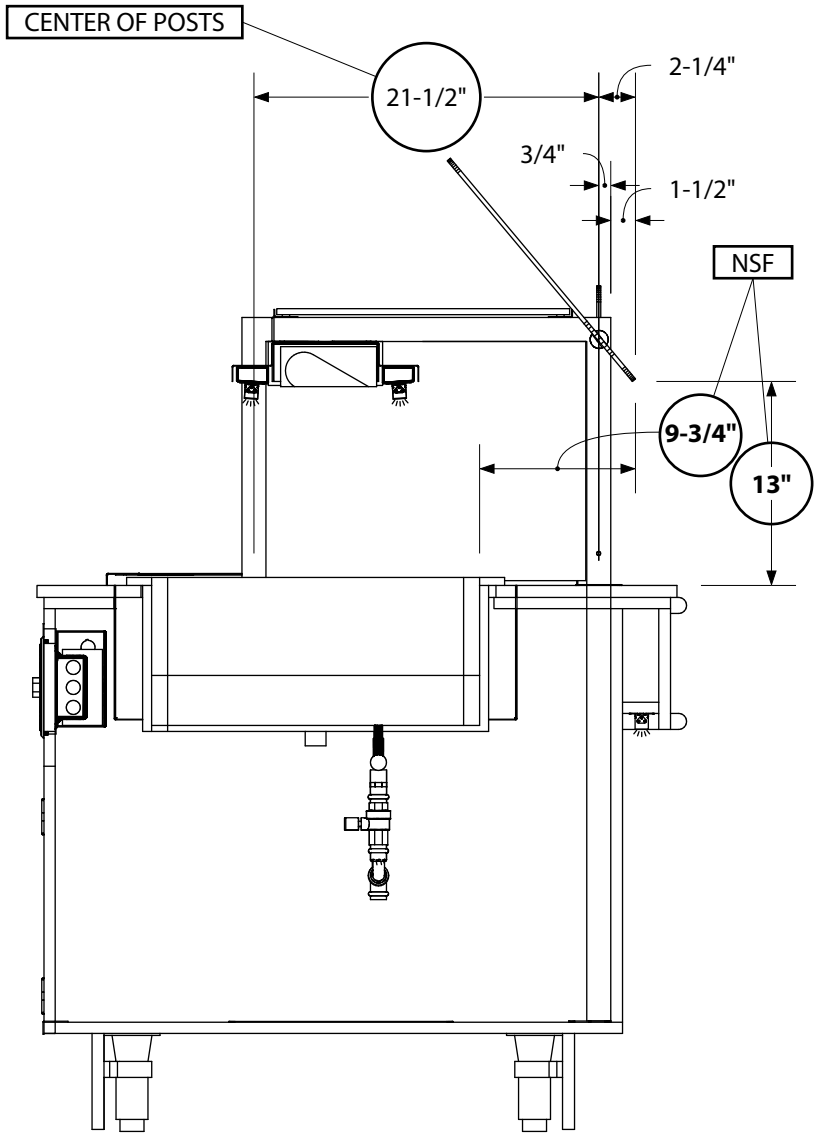
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TYPICAL ALIGNMENT OF FOOD PAN IN REFERENCE TO SELF-SERVICE GLASS (NSF)



1 Section View - NSF

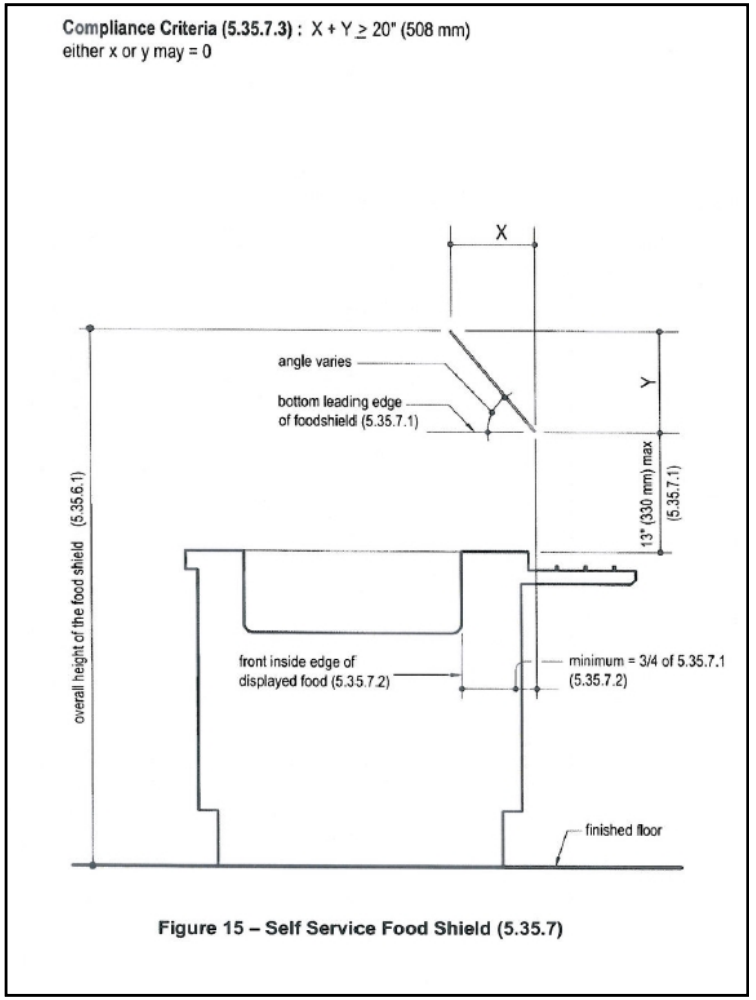


Figure 15 – Self Service Food Shield (5.35.7)

CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

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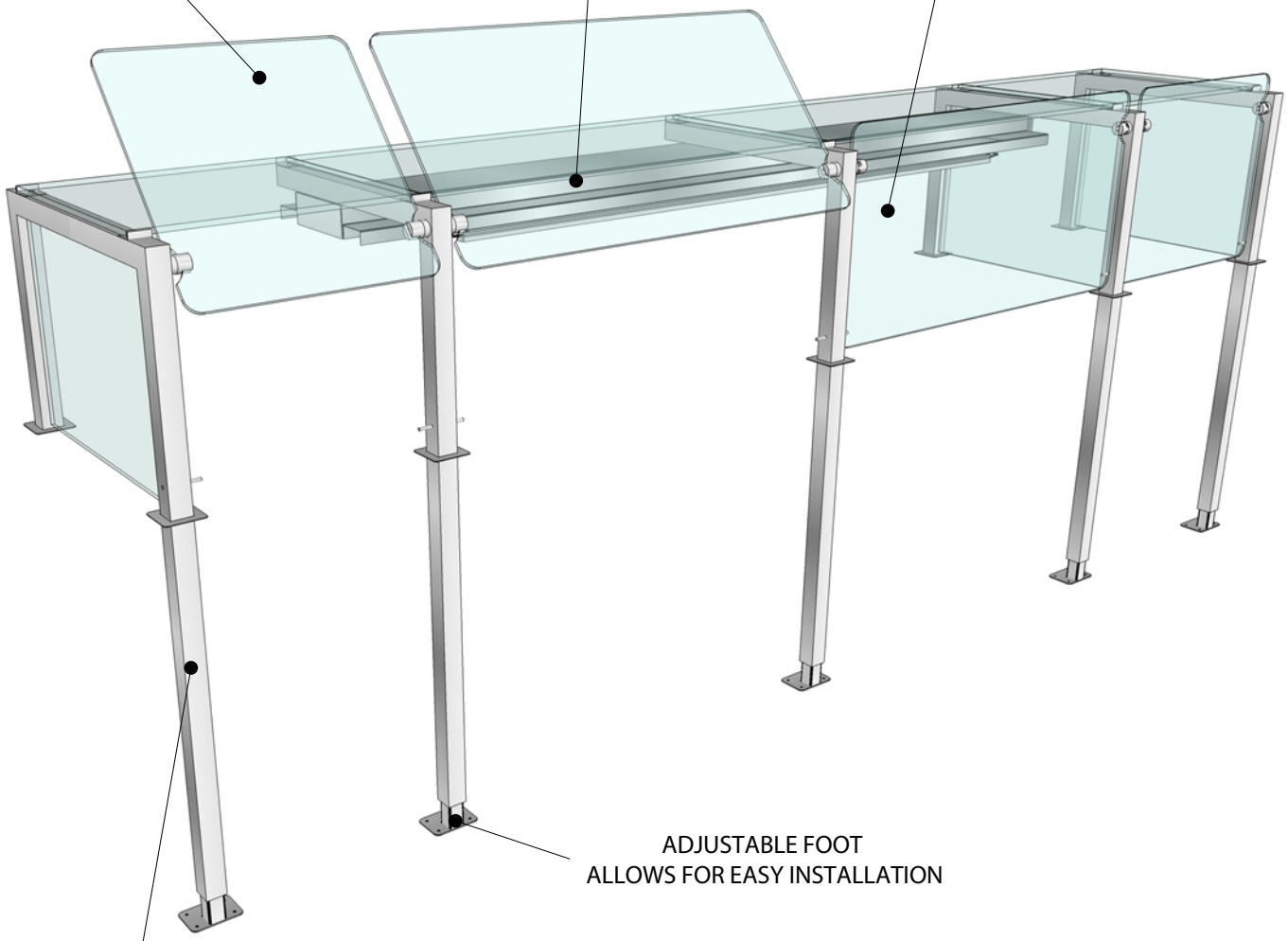
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AVAILABLE IN OVERHEAD LED LIGHTING
OR OVERHEAD HEAT WITH LED LIGHTING
BOTH WITH STAINLESS STEEL SHROUD

GLASS SHOWN IN SELF-SERVICE POSITION

GLASS SHOWN IN SERVICE POSITION



ADJUSTABLE FOOT
ALLOWS FOR EASY INSTALLATION

FRONT SQUARE TUBING EXTENDS THROUGH COUNTERTOP
FOR ADDED STRENGTH AND INCREASED SPAN
(OPTIONAL SHORTER FRONT POSTS FOR SHORTER SPANS)

CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

REF. # 45429-03SIM

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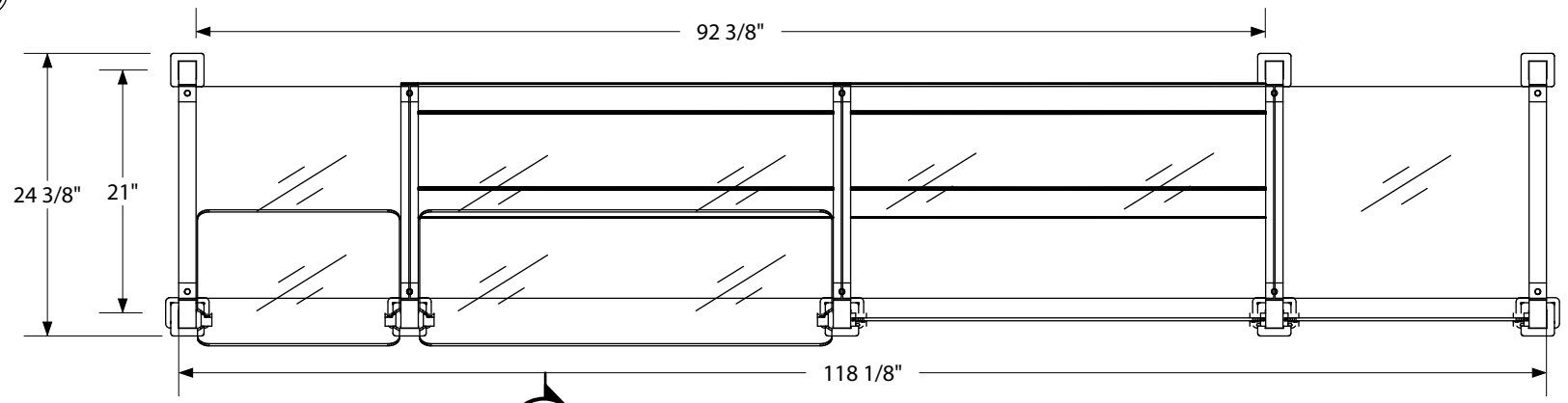
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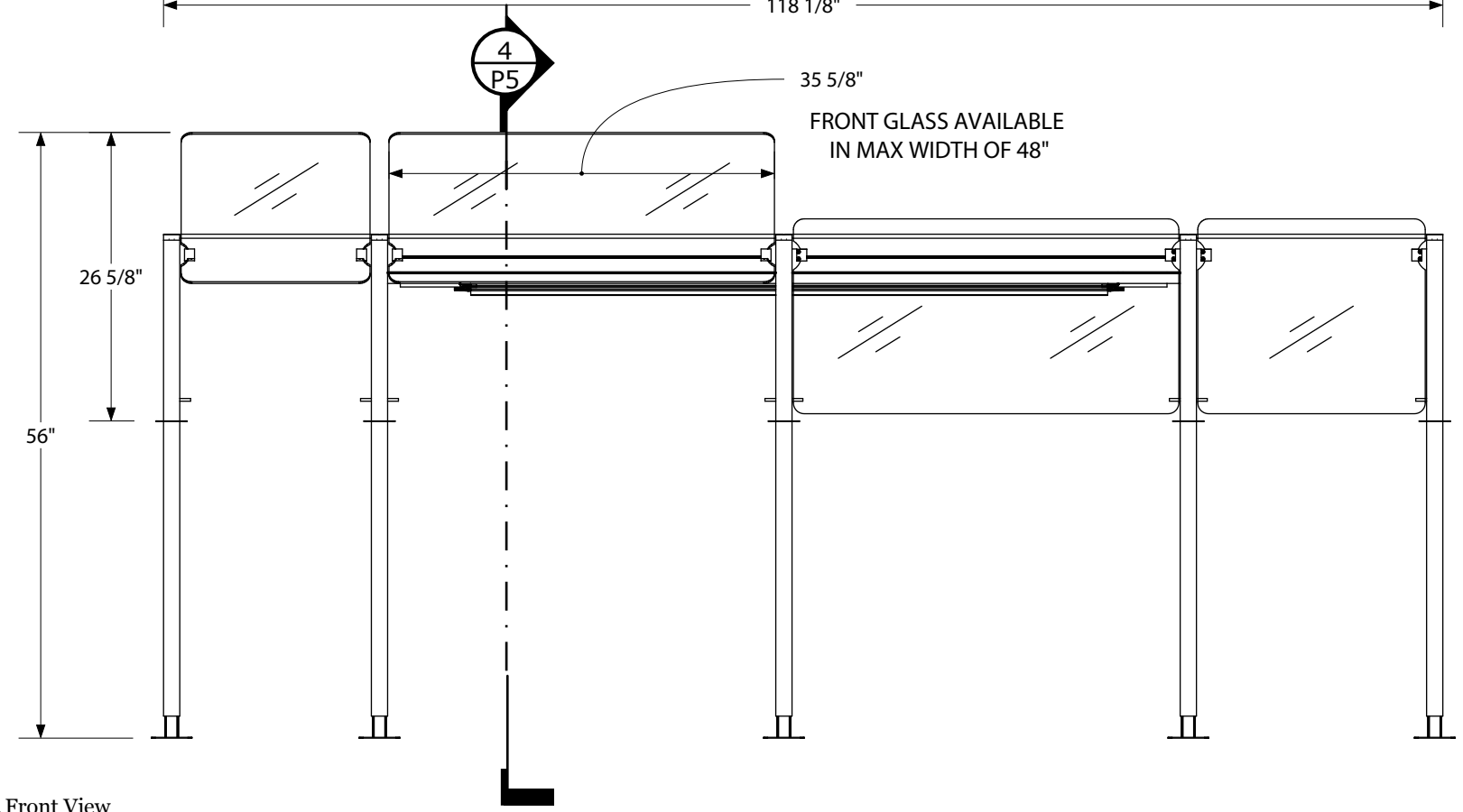
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2 Plan View





3 Front View

CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

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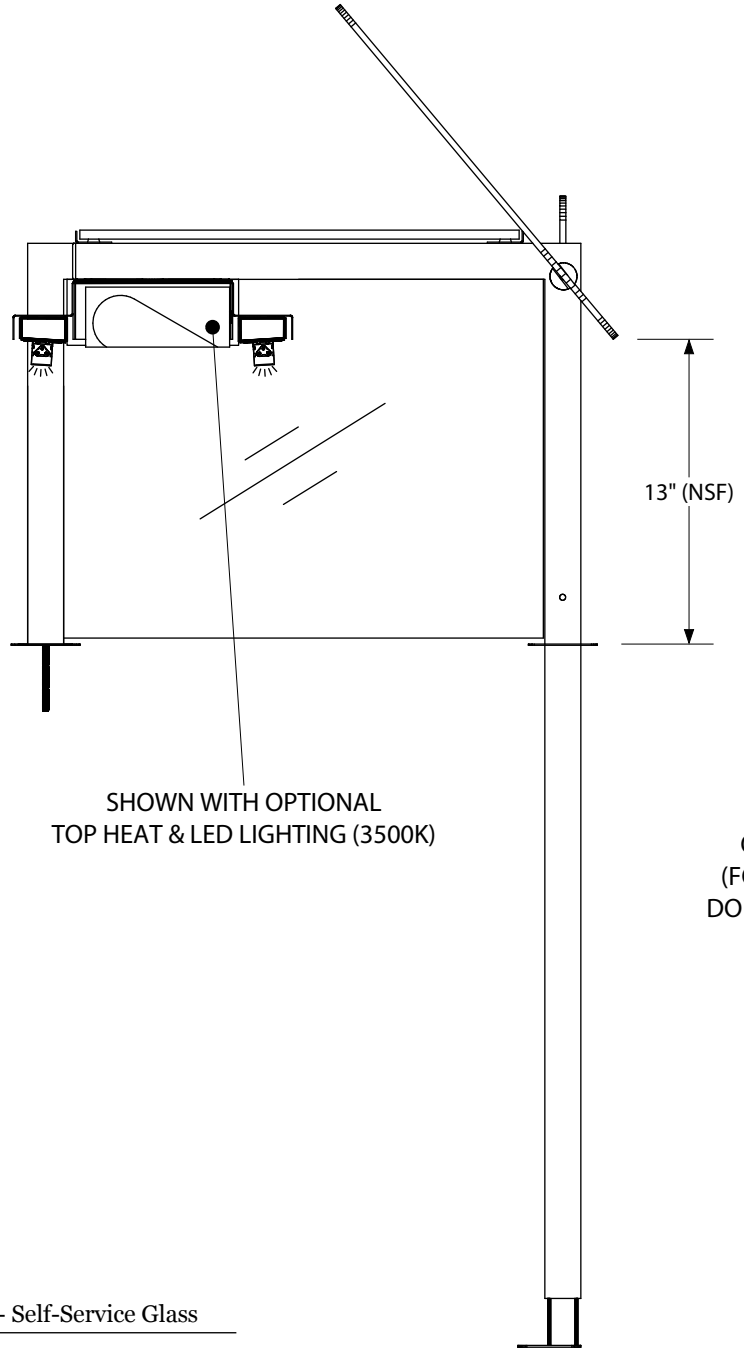
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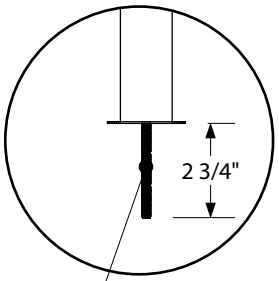
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OPTIONAL BOLTED FRONT POST
(FOR SMALLER APPLICATIONS THAT
DO NOT REQUIRE A LARGE REAR SPAN)

4 Section View - Self-Service Glass

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CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

REF. # 45429-03SIM

REVISIONS

1	NTE 3/7/2018

Drawn By:NTE

Date: 1-31-2018

Sheet No.
5 of 5

Project #
45700-01

PIPER ELITE 500

Solid Top Unit



3-ST shown with optional elementary height solid tray slide and formica finish

The Elite 500 Solid Top's versatile modular design allows you to custom design either a cafeteria or a buffet line-up. Elite 500 units are compatible and will interlock with other Elite 500 units. This allows the units to be disconnected for cleaning under the serving line. With Elite 500 you choose only the options and accessories that you want and need.

STANDARD FEATURES

- 14-gauge stainless steel top with 1-1/2" turn down on all sides
- Top secured by four recessed bolts
- 14-gauge stainless steel legs fastened to 18-gauge stainless steel bottom shelf
- 20-gauge stainless steel end and front panels are attached to legs
- Open control side for additional storage capacity
- 5" diameter swivel plate casters, 2 with brakes
- Interlocking mechanism is provided to interlock with other Elite 500 units

JOB_____ ITEM # _____ QTY # _____

MODEL NUMBER

- ❑ 2-ST (500)
- ❑ 3-ST (500-1)
- ❑ 4-ST (500-2)
- ❑ 5-ST (500-3)
- ❑ 6-ST (500-4)

DIMENSIONS

- 2-ST(500) - 36"H x 28"D x 32"L
- 3-ST(500-1) - 36"H x 28"D x 46"L
- 4-ST(500-2) - 36"H x 28"D x 60"L
- 5-ST (500-3)- 36"H x 28"D x 74"L
- 6-ST(500-4) - 36"H x 28"D x 88"L
- 36" height on all standard units
- 30" height is available on Petite Elite units
- 28" width
- 32" to 88" length in 14" increments

COMMON OPTIONS

- **PIZZAZZ POWDER COATING IN LIEU OF STAINLESS STEEL**
- Tray slides
- Protector guards
- Hinged or sliding doors
- See reverse side for additional options.

WARRANTY

One year parts and labor. Warranty is detailed on inside front cover of the price list.

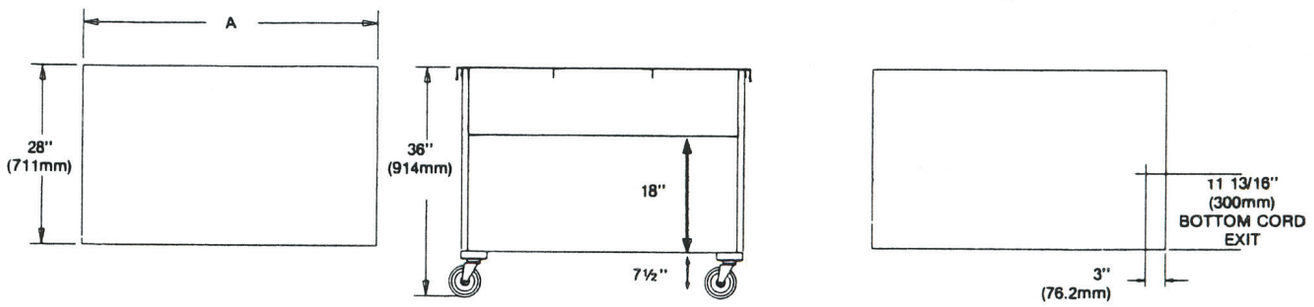
SPEC A-3

PIPER
The Food-Focused Equipment Company
a CFSBRANDS company
www.piperonline.net

300 S. 84th Avenue
Wausau, WI 54401
Phone: 800-544-3057
Fax: 715-842-3125

PIPER ELITE 500

Solid Top Unit



SOLID TOP UNIT SPECIFICATIONS

Model#	Length	Width	Height	Ship Wt. (lbs)
2-ST(500)	32”	28”	36”	225
3-ST(500-1)	46”	28”	36”	265
4-ST(500-2)	60”	28”	36”	302
5-ST(500-3)	74”	28”	36”	345
6-ST(500-4)	88”	28”	36”	385

DIMENSION ADDITIONS FOR OPTIONS

- ❑ Add 23-3/4” to height for buffet protector guard
- ❑ Add 14” to height for cafeteria protector guard
- ❑ Add 22-3/4” to height for double display shelf
- ❑ Add 8” to width for cutting board
- ❑ Add 12-3/4” to width for solid ribbed tray slide
- ❑ Add 12-1/2” to width for 3-bar tray slide

Note: Line-up drawing required when ordering false front, cashier stand or interconnected units.

OPTIONS / ACCESSORIES

	Part #	Description
❑	PPC	Pizzazz Powder Coating
❑	SCB	8” stainless steel cutting board, flush with top
❑	MCB	8” maple cutting board, flush with top
❑	SRTS	Solid 3-ribbed tray slide, 16-gauge stainless steel
❑	3BTS	3-bar tray slide
❑	MBS	18” maple end bread shelf; left, right - flush with top
❑	SBS	18” stainless steel end bread shelf; left, right - flush with top
❑	CPG	Cafeteria protector guard (no heat or lights)
❑	CPGL	Cafeteria protector guard with incandescent lights
❑	CPGFL	Cafeteria protector guard with fluorescent lights
❑	CPGHL	Cafeteria protector guard with heat and lights
❑	CDD	Cafeteria double display (no heat or lights)
❑	CDDL	Cafeteria double display with fluorescent lights
❑	BPG1	Buffet single side protector guard (no heat or lights)
❑	BPG1IL	Buffet single side protector guard with incandescent lights
❑	BPG1FL	Buffet single side protector guard with fluorescent lights

	Part #	Description
❑	BPG	Buffet double side protector guard (no heat or lights)
❑	BPGIL	Buffet double side protector guard with incandescent lights
❑	BPGFL	Buffet double side protector guard with fluorescent lights
❑	BPGH	Buffet double side protector guard with heat strip
❑	BDD	Buffet double display two-sided protector guard
❑	BPGC	Buffet classic two-sided protector guards
❑	CPGC	Cafeteria Style Classic (1-5/8) protector guards
❑	CDDC	Cafeteria Style Classic Double Display protector guards
❑	BPG1C	Buffet Style Classic Single Sided protector guards
❑	SCPGC	Cafeteria Style Classic Single protector guards
❑	SSL	Legs in lieu of casters
❑	DOUT	Duplex outlet (120V, 15 AMP)
❑	FRMA	Formica laminate finish without doors
❑	CUT	Cut out for drop in dispensers.
❑	UCR-1	Refrigerated storage base with doors - for units 60” or larger
❑	UCR-2	Refrigerated storage base 74” or larger
❑	INT	Intermediate shelf

A-3 SPEC

PIPER
The Food-Focused Equipment Company
a CFSBRANDS company
www.piperonline.net

300 S. 84th Avenue
Wausau, WI 54401
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LIMITED WARRANTY: PIPER PRODUCTS warrants to the original purchaser parts and labor for a period of twelve (12) months from the date of purchase. See manufacturer’s complete warranty for details.

It is our policy to build equipment which is design certified by companies that have been accredited at the Federal Level by the Occupational Safety and Health Agency (OSHA) and ANSI as a National Recognized Testing Laboratory. These companies include CSA International, Underwriters Laboratories, and the National Sanitation Foundation. However, a continuing program of product improvement makes it necessary to submit new models to the agencies as they are developed. Consequently, all models may not bear the appropriate labels at all times.

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PIPER ELITE 500

Hot Food Unit

JOB_____ ITEM # _____ QTY # _____

MODEL NUMBER

- ❑ 2-HF (501-2)
- ❑ 3-HF (501-3)
- ❑ 4-HF (501-4)
- ❑ 5-HF (501-5)
- ❑ 6-HF (501-6)



FoodSafe™

3-HF Elite 500 shown with optional 3-bar tray slide and formica finish

The versatile modular design of the Elite 500 Serving System Hot Food units allows you to customize your cafeteria or a buffet line-up. Elite 500 units are compatible and will interlock with other Elite 500 units. This design allows the units to be disconnected for cleaning under the serving line. With Elite 500 you choose only the options and accessories that you want and need for your line-up.

Only Piper's equipment has the advantage of FoodSafe technology and certification. This ensures that your food is kept "out of the **Danger-Zone**." Food spoilage occurs mainly because of rapidly accelerated bacteriological activity within the 40F-140F **"Danger Zone."**

With FoodSafe hot food stays above 140F longer and cold food is kept below 40F. Both are key factors in HACCP compliance and the fight against foodborne pathogens.

STANDARD FEATURES

- 14-gauge stainless steel top with 1-1/2" turndown on all sides
- Top secured by four recessed bolts for easy access
- 14-gauge stainless steel legs fastened to
- 18-gauge stainless steel bottom shelf, open control side
- Open control side for additional storage capacity
- 20-gauge stainless steel end and front panels are attached to legs
- 20-gauge stainless steel bottom-mounted wells, 6-1/2" deep with coved corners
- 2" insulation on sides and between wells, 1-1/2" on bottom, 1" on the ends and 1/4" fiber frax all around
- 1000 watt tubular heating element for each well is individually and thermostatically controlled
- Wells can be run wet or dry
- 5" diameter swivel plate casters, 2 with brakes
- Interlocking mechanism is provided to interlock with other Elite 500 units.
- Drain valve exits operator's left side as standard. Drain valve is 3/4" FPT.
- Common drains and manifolds

DIMENSIONS

- 2-HF (501-2) - 36"H x 28"D x 32"L
- 3-HF (501-3) - 36"H x 28"D x 46"L
- 4-HF (501-4) - 36"H x 28"D x 60"L
- 5-HF (501-5) - 36"H x 28"D x 74"L
- 6-HF (501-6) - 36"H x 28"D x 88"L
- 36" height on all standard units
- 30" height is available on Petite Elite 500 units
- 28" width
- 32" to 88" length in 14" increments

ELECTRICAL

- Two, three and four well units are available 120 volts
- All units available in 208 or 240 volt, single- phase standard
- Eight foot electrical cord and plug
- Some options or accessories may not be available with certain voltages

COMMON OPTIONS

- **PIZZAZZ POWDER COATING IN LIEU OF STAINLESS STEEL**
- Tray slides
- Protector guards
- Hinged or sliding doors
- See reverse side for additional options

WARRANTY

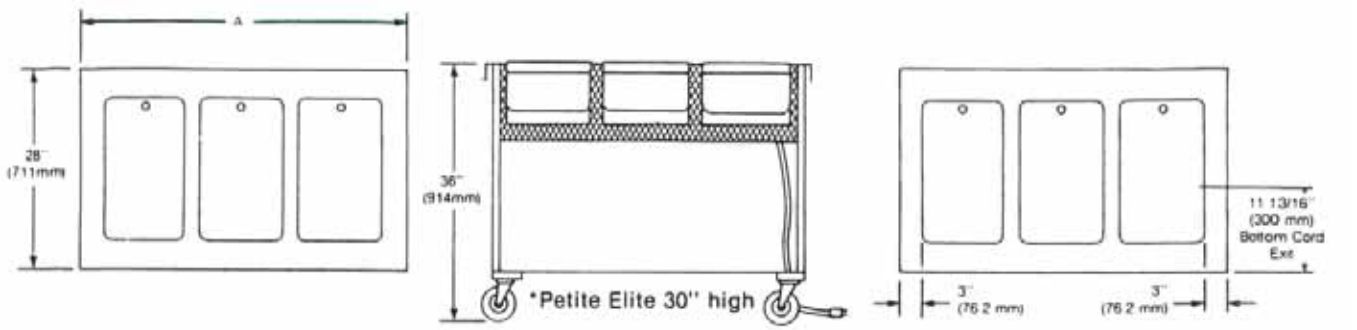
One year parts and labor. Warranty is detailed on inside front cover of the price list.

SPEC A-1

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PIPER ELITE 500

Hot Food Unit



Model#	# of Wells	A	Watts	120V	Amps 208V	240V	NEMA Cap Number 120V	208V	240V	Ship Wt. (lbs)
2-HF (501-2)	2	32"	2000	16.7	9.6	8.3	5-30P	6-15P	6-15P	300
3-HF (501-3)	3	46"	3000	25.0	14.4	12.5	5-50P	6-20P	6-20P	310
4-HF (501-4)	4	60"	4000	33.3	19.2	16.7	5-50P	6-30P	6-30P	335
5-HF (501-5)	5	74"	5000	N/A	24.0	20.8	N/A	6-30P	6-30P	375
6-HF (501-6)	6	88"	6000	N/A	28.8	25.0	N/A	6-50P	6-50P	400

Spacing between wells is 2". Floor clearance of unit is 6-1/4". Clearance height of open under storage is 17-3/4". Open under storage widths are 22-3/16", 36-3/16",50-3/16", 64-3/16", and 78-3/16".

DIMENSION ADDITIONS FOR OPTIONS

- Add 23-3/4" to height for buffet protector guard
- Add 14" to height for cafeteria protector guard
- Add 22-3/4" to height for double display shelf
- Add 8" to width for cutting board
- Add 12-3/4" to width for solid ribbed tray slide
- Add 12-1/2" to width for 3-bar tray slide

Note: Line-up drawing required when ordering false front, cashier stand or interconnected units.

	Part #	Description
❑	PPC	PIZZAZZ POWDER COATING
❑	SCB	8" stainless steel cutting board, flush with top
❑	MCB	8" maple cutting board, flush with top
❑	SRTS	Solid 3-ribbed tray slide, 16-gauge stainless steel
❑	3BTS	3-bar tray slide
❑	MBS	18" maple end bread shelf; left, right - flush with top
❑	SBS	18" stainless steel end bread shelf; left, right - flush with top
❑	HD	Hinged doors with solid bottom
❑	SD	Sliding doors with solid bottom
❑	CPG	Cafeteria protector guard (no heat or lights)
❑	CPGL	Cafeteria protector guard with incandescent lights
❑	CPGFL	Cafeteria protector guard with fluorescent lights
❑	CEG	Cafeteria end guards, right or left
❑	INT	Intermediate shelf
❑	FPB	Full perimeter bumper

	Part #	Description
❑	BPG1	Buffet single side protector guard (no heat or lights)
❑	BPG1IL	Buffet single side protector guard with incandescent lights
❑	BPG1FL	Buffet single side protector guard with fluorescentlights
❑	BEG	Buffet end guards, right or left
❑	BDD	Buffet double display two-sided protector guard
❑	BPGC	Classic protector guards
❑	CPGC	Cafeteria Style Classic Single protector guard
❑	BPG1C	Buffet Style Classic Single Sided protector guard
❑	SCPGC	Cafeteria Style Classic Single protector guards
❑	SSL	Legs in lieu of casters
❑	DOUT	Duplex outlet (120V, 15 AMP)
❑	FRMA	Formica laminate finish
❑	FLP	Filler Strips
❑	FF	Fill Faucet
❑	SKR	Skirting

A-1 SPEC

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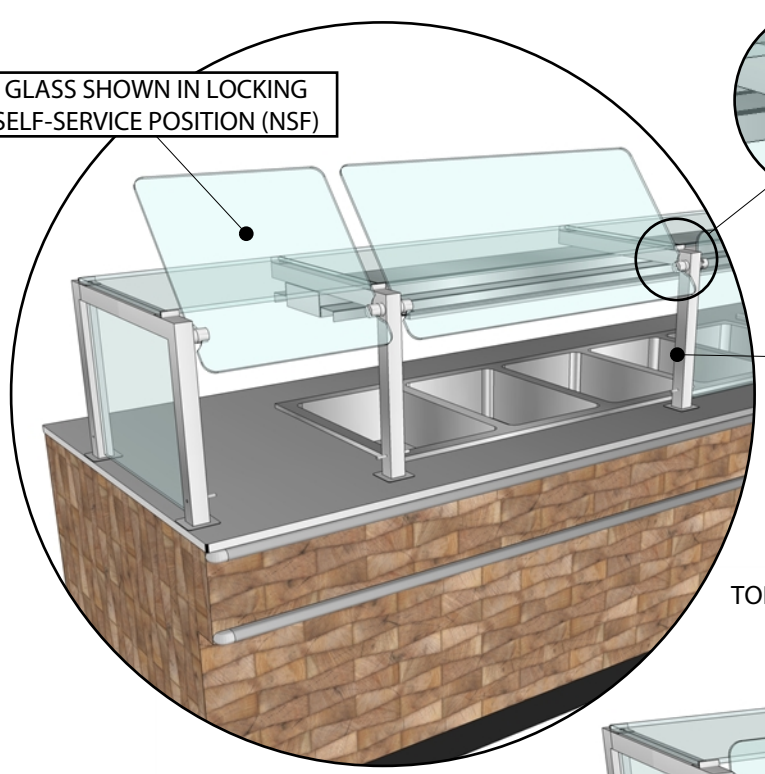
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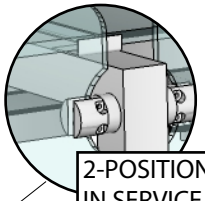
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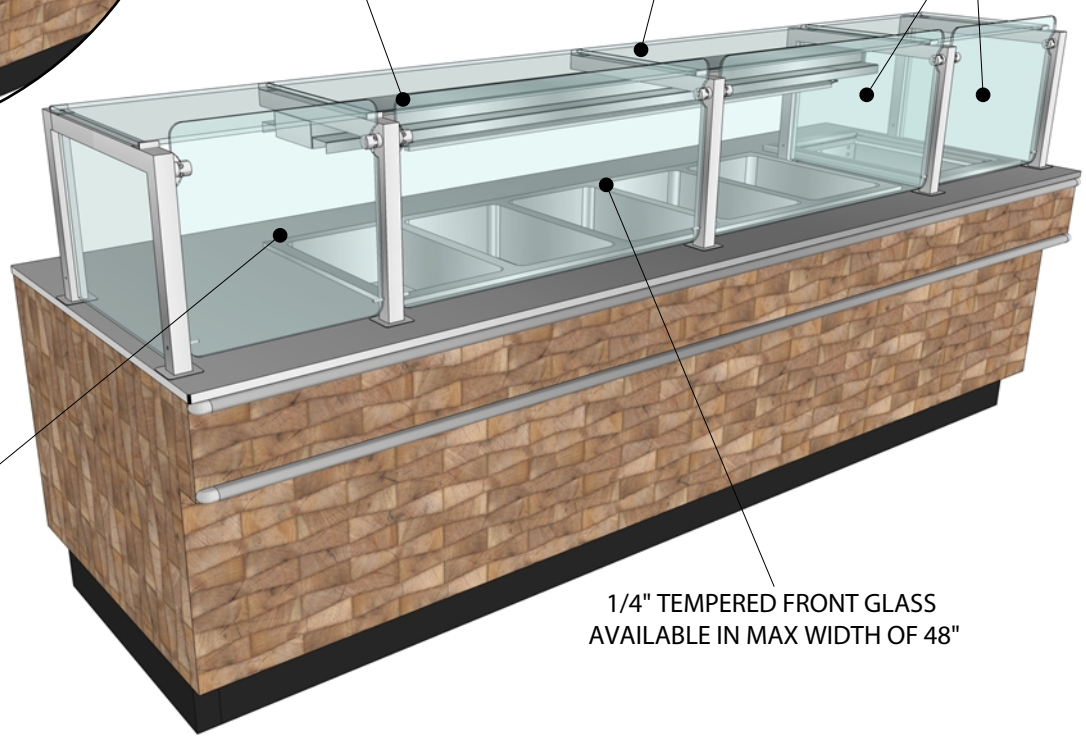


CONSTRUCTED OF 1-1/2" SQUARE TUBING
(BRUSHED STAINLESS STEEL OR POWDER COATED FINISH)

3/8" TEMPERED TOP GLASS

SHOWN WITH OPTIONAL TEMPERED END & DIVIDER GLASS

SHOWN WITH OPTIONAL TOP HEAT & LED LIGHTING (3500K)



GLASS SHOWN IN SERVICE POSITION

1/4" TEMPERED FRONT GLASS AVAILABLE IN MAX WIDTH OF 48"

CONVERTIBLE GUARD SHOWN ON PIPER INLINE HOT/COLD BAR

CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

REF. # 45429-03SIM

REVISIONS

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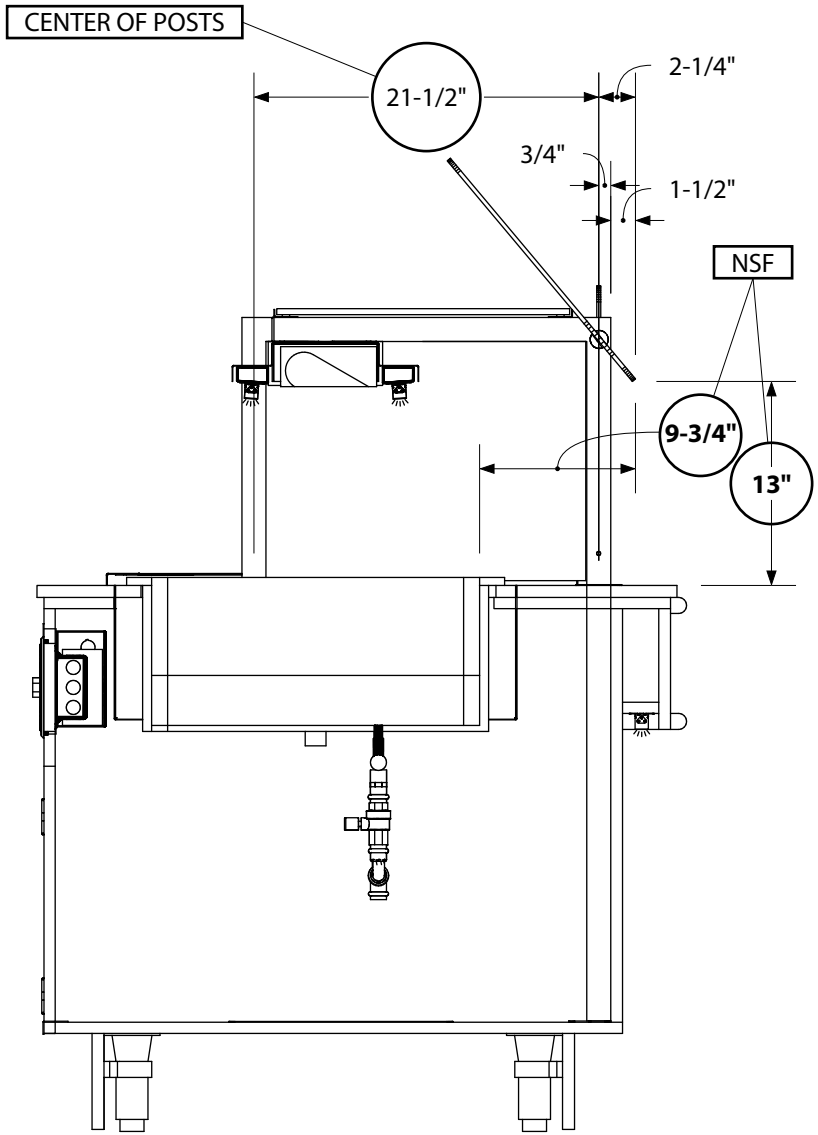
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TYPICAL ALIGNMENT OF FOOD PAN IN REFERENCE TO SELF-SERVICE GLASS (NSF)



1 Section View - NSF

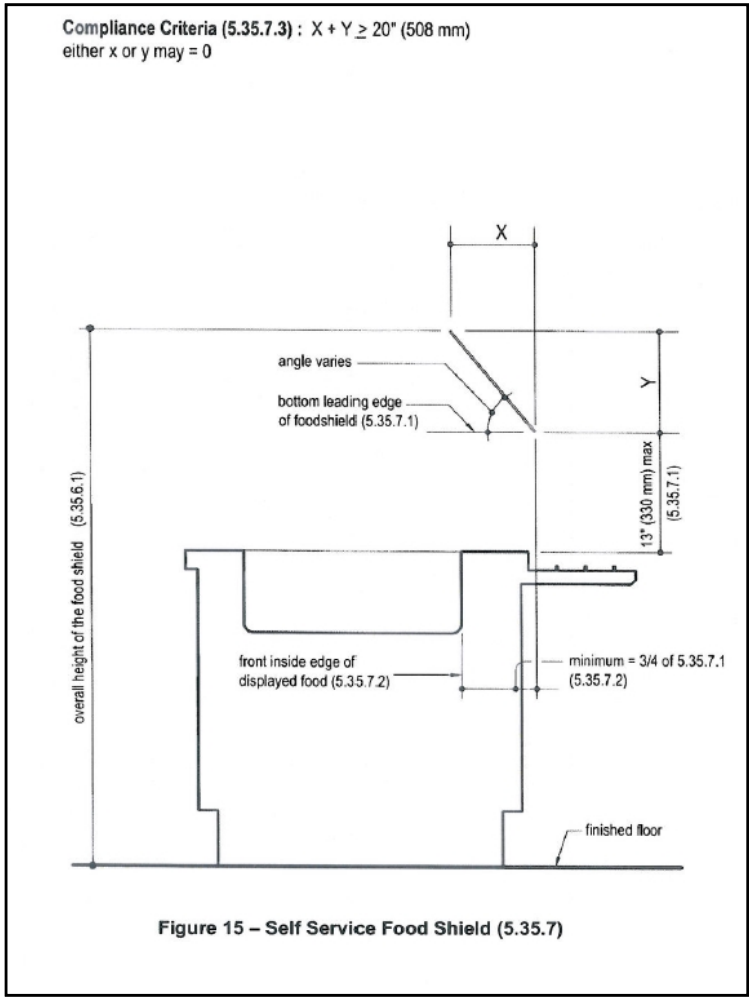


Figure 15 – Self Service Food Shield (5.35.7)

CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

REF. # 45429-03SIM

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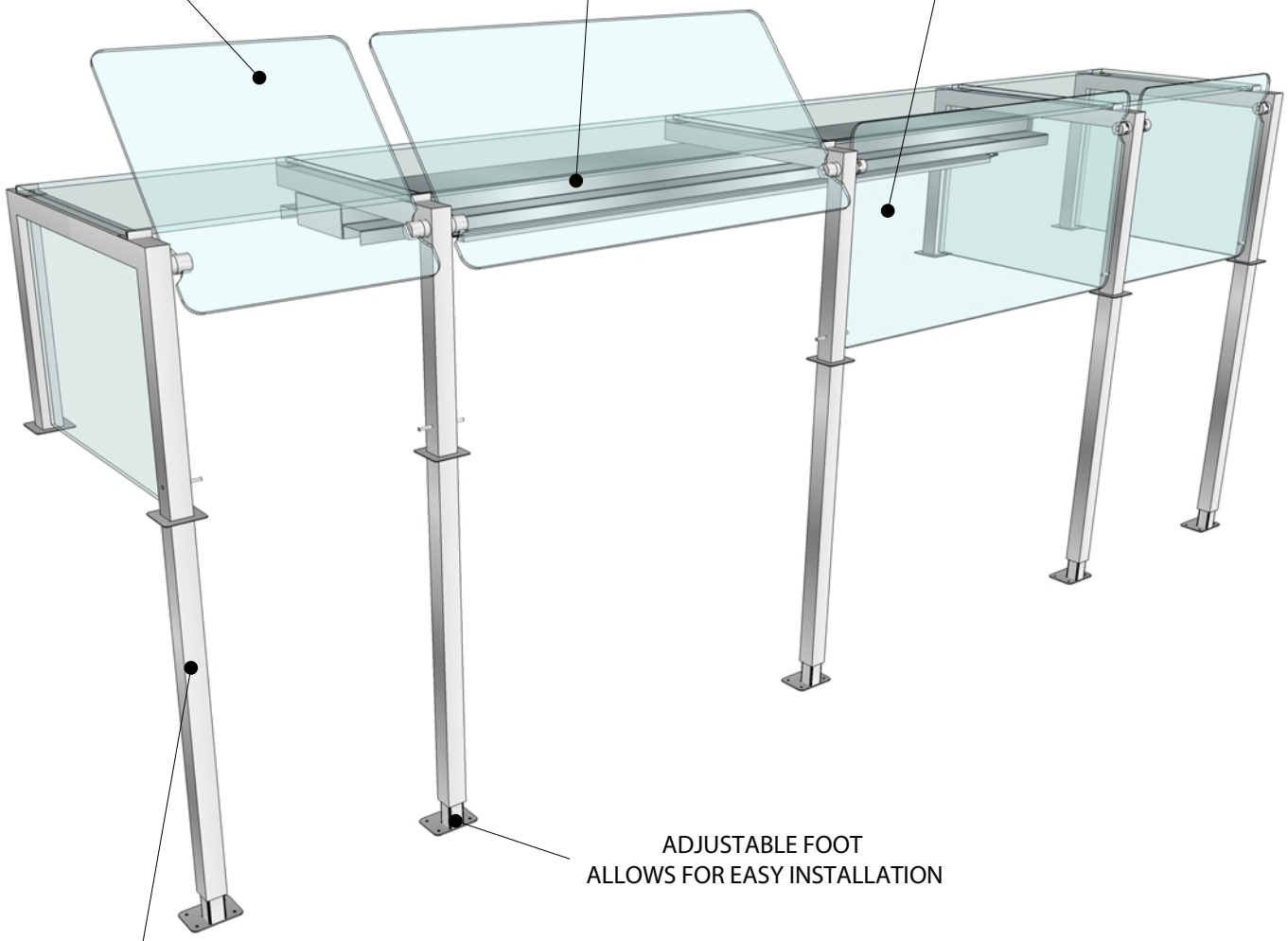
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sales@rdfixtures.com

AVAILABLE IN OVERHEAD LED LIGHTING
OR OVERHEAD HEAT WITH LED LIGHTING
BOTH WITH STAINLESS STEEL SHROUD

GLASS SHOWN IN SELF-SERVICE POSITION

GLASS SHOWN IN SERVICE POSITION



ADJUSTABLE FOOT
ALLOWS FOR EASY INSTALLATION

FRONT SQUARE TUBING EXTENDS THROUGH COUNTERTOP
FOR ADDED STRENGTH AND INCREASED SPAN
(OPTIONAL SHORTER FRONT POSTS FOR SHORTER SPANS)

CONVERTIBLE GUARD (CG)
SERVICE / SELF-SERVICE

REF. # 45429-03SIM

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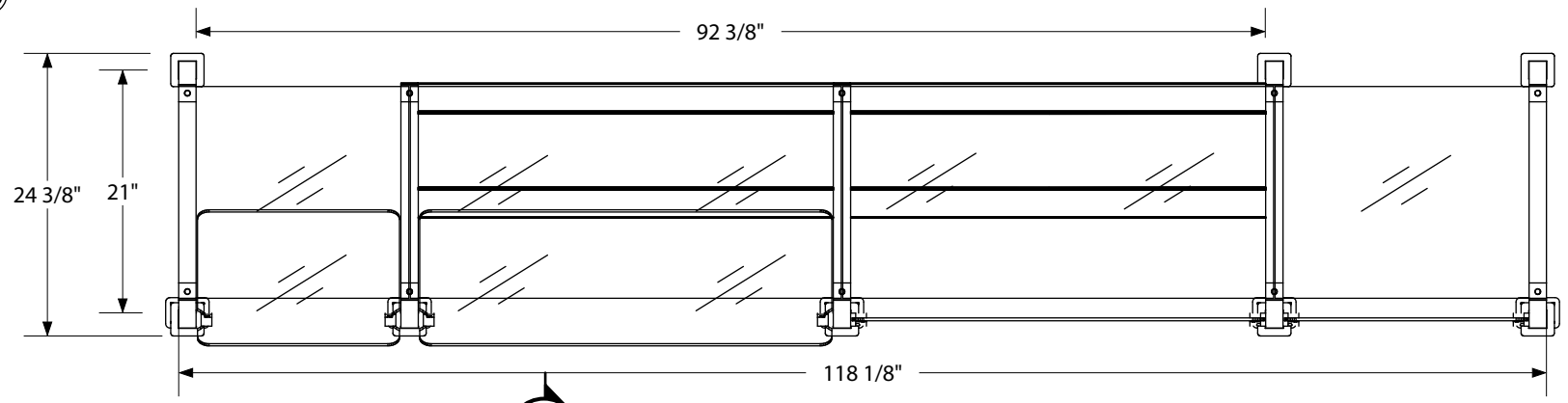
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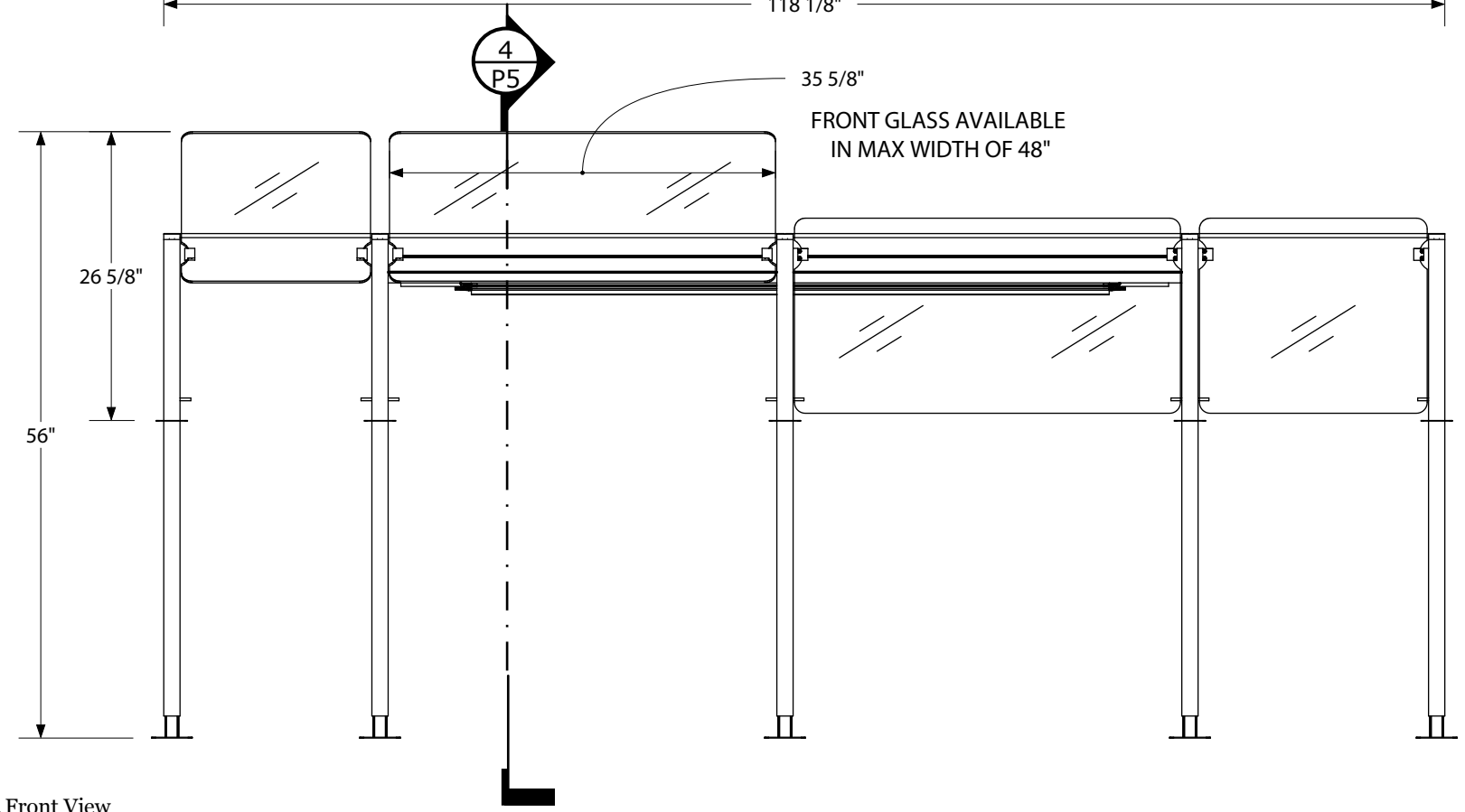
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CONVERTIBLE GUARD (CG) SERVICE / SELF-SERVICE

2 Plan View





3 Front View

REF. # 45429-03SIM

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Project #

45700-01

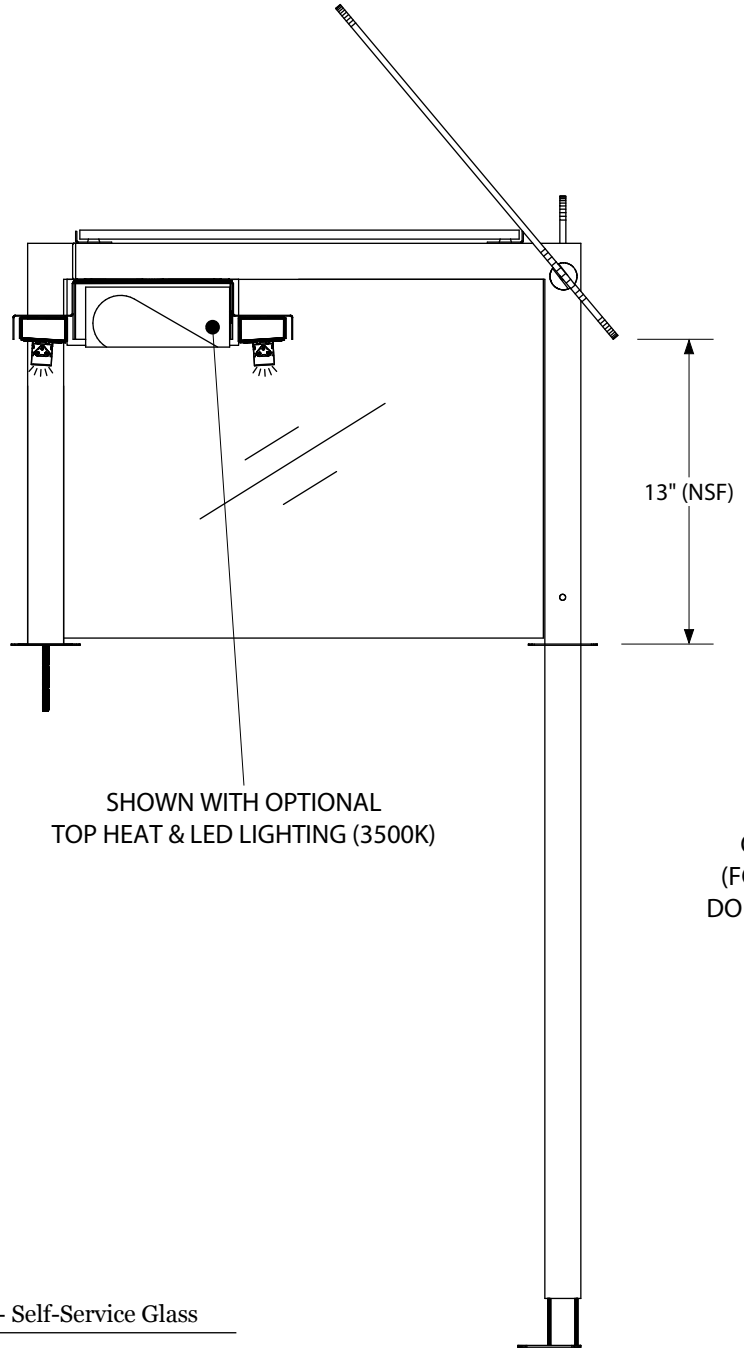
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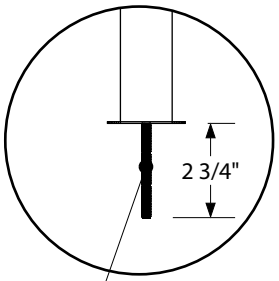
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OPTIONAL BOLTED FRONT POST
(FOR SMALLER APPLICATIONS THAT
DO NOT REQUIRE A LARGE REAR SPAN)

4 Section View - Self-Service Glass

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Project #
45700-01

PIPER ELITE 500

Cashier Stand



The Elite 500 Cashier Stand is a comfortable workstation. Ideal for use in cafeteria/buffet lines. This Elite 500 unit is compatible and will interlock with other Elite 500 units or the cashier stand can be operated as a freestanding separate unit.

STANDARD FEATURES

- 14-gauge stainless steel top with 1-1/2" turndown on all sides
- Top secured by four recessed bolts for easy access
- 14-gauge stainless steel legs fastened to 18-gauge stainless steel bottom shelf
- 20-gauge stainless steel end and front panels are attached to legs
- Standard unit comes with a solid bottom
- Hole in top with bushing for cash register cord **(standard)**
- Locking drawer **(standard)**
- 5" diameter swivel plate casters, 2 with brakes
- Interlocking mechanism is provided to interlock with other Elite units
- The utility drawer is centered in the panel on the open side and mounted on roller bearing slides

JOB_____ ITEM # _____ QTY # _____

MODEL NUMBER

❑ 2-CD
- with drawer

❑ 2-CR
- corner unit

❑ 2-MCU
- mitered corner unit

Consult factory for unit specification on a corner or mitered unit.

DIMENSIONS

- 2-CD - with drawer - 36"H x 28"D x 30"L
- 2-CR - corner unit - 36"H x 28"D x 28"L
- 36" height on all standard units
- 30" height is available on Petite Elite units
- 28" width
- 30" length

COMMON OPTIONS

❑ **PIZZAZZ POWDER COATING IN LIEU OF STAINLESS STEEL**
❑ Tray slides
❑ Tubular foot rest
❑ Duplex outlet
❑ See reverse side for additional options

WARRANTY

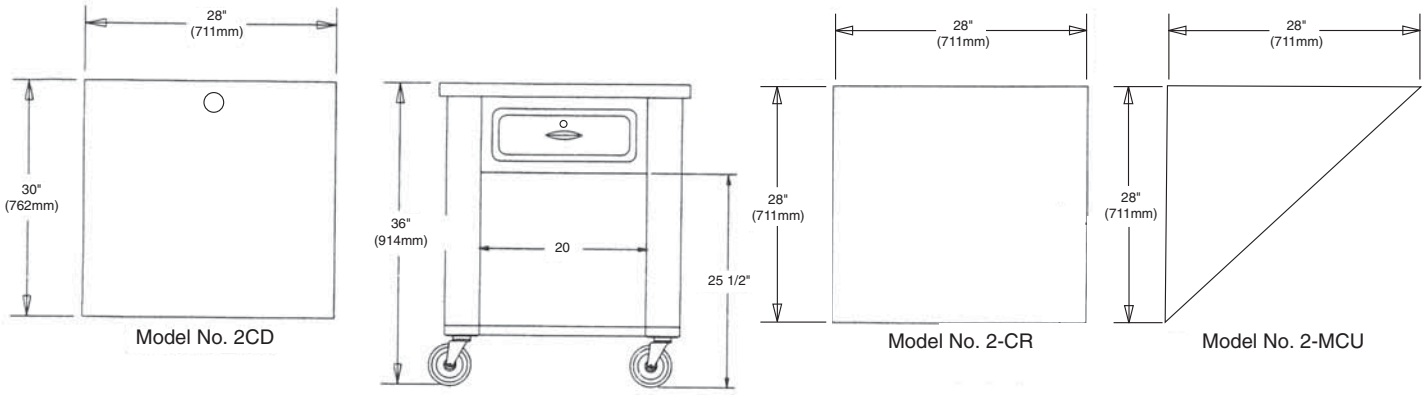
One year parts and labor. Warranty is detailed on inside front cover of the price list.

SPEC A-11

PIPER PRODUCTS
BUILT TO LAST
www.piperonline.net
300 S. 84th Avenue
Wausau, WI 54401
Phone: 800-544-3057
Fax: 715-842-3125

PIPER ELITE 500

Cashier Stand



OPTIONS / ACCESSORIES

	Part #	Description
❑	**PPC**	**Pizzazz Powder Coating**
❑	SRTS	Solid 3-ribbed tray slide, 16-gauge stainless steel
❑	3BTS	3-bar tray slide
❑	SSL	Legs in lieu of casters
❑	DOUT	Duplex outlet (120V, 15 AMP)
❑	FRMA	Formica laminate finish
❑	TFR	Tubular foot rest
❑	SKR	Skirting

CASHIER STAND UNIT SPECIFICATIONS

Model#	Length	Width	Height	Ship Wt. (lbs)
2-CD with drawer	30"	28"	36"	165
2-CR Corner unit	28"	28"	36"	160
Mitered Corner unit	–	28"	36"	140

Drawer is 16" wide, 19" long and 2-1/2" deep.

DIMENSION ADDITIONS FOR OPTIONS

- Add 12-3/4" to width for solid ribbed tray slide
- Add 12-1/2" to width for 3-bar tray slide
- 30" height is available on Petite Elite units

Note: Line-up drawing required when ordering a cashier stand or interconnected units.

A-11 SPEC

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LIMITED WARRANTY: PIPER PRODUCTS warrants to the original purchaser parts and labor for a period of twelve (12) months from the date of purchase. See manufacturer's complete warranty for details.

It is our policy to build equipment which is design certified by companies that have been accredited at the Federal Level by the Occupational Safety and Health Agency (OSHA) and ANSI as a National Recognized Testing Laboratory. These companies include CSA International, Underwriters Laboratories, and the National Sanitation Foundation. However, a continuing program of product improvement makes it necessary to submit new models to the agencies as they are developed. Consequently, all models may not bear the appropriate labels at all times.

We reserve the right to change specifications and product design without notice. Such revisions do not entitle buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment. Information is not for design purposes.