PROJECT MANUAL
and
TECHNICAL SPECIFICATIONS

PARK and AQUATIC FACILITY IMPROVEMENTS

New Britain Bid Number 3896

A.W. Stanley Park

2100 Stanley Street
New Britain, Connecticut

TLBA Project No. 2015.021

Project Architect:

TLB Architecture, LLC
92 West Main Street
Chester, Connecticut 06412

Issued for Bid and Construction
22 August 2016

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INVITATION FOR BIDS

The CITY OF NEW BRITAIN, acting through the City Purchasing Agent, will receive bids for:

Park and Aquatic Facility Improvements
AW Stanley Park
New Britain, Connecticut

Bids will be received at the Office of the Purchasing Department, Room 401 - City Hall, 27 West Main Street, New Britain, CT. 06051, no later than **11:00 AM on Wednesday September 14, 2016** at which time all bids will be publicly opened and read aloud. The work generally consists of the construction of a new bathhouse, swimming pool and maintenance building, as well as renovation of parking areas, baseball field and basketball courts, with associated site work.

The Bid Documents may be viewed at said Office of the Purchasing Department, Room 401 - City Hall, on or after **12:00 noon on Tuesday, August 23, 2016.** The Bid Documents will also be available for viewing and downloading from the City's website **http://bids.newbritainct.gov.** Prints of the Bid Documents are available at Joseph Merritt & Company, 650 Franklin Avenue, Hartford, CT 06114 for a **non-refundable payment at-cost to the printer. Contractors are to call ahead to request Bid Documents. Pre-printed Bid Documents will not be available.**

The City reserves the right to accept or reject any or all bids or any part of a bid presented, or to invite proposals as its interest may appear.

A pre-bid conference shall be held at 10:00am on Friday, September 2, 2016, at the project site, 2100 Stanley Street, New Britain. Interested Bidders are strongly encouraged to attend.

Attention is called to the fact that not less than the minimum salaries and wages as set forth in the Bid Documents must be paid on this project; proper classification of workers as employees rather than as independent contractors must be made. Where one or more apprentices are employed, Contractor must participate in a state-certified apprenticeship program. The Contractor must ensure that employees and applicants for employment are not discriminated against because of their race, sex, religions, color or national origin. The Contractor must adhere to all relevant provisions of Section 46a-95 of the Connecticut General Statutes, and any other relevant laws and regulations regarding Affirmative Action.

The Contractor shall comply with the Copeland Anti-Kickback Act and Regulations of the Secretary of Labor (29 CFR, Part 3).

JACK PIEPER
PURCHASING AGENT

INSTRUCTIONS TO BIDDERS

1. RECEIPT AND OPENING OF BIDS

The City of New Britain, (herein called the "Owner"), invites bids on the form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner at the Office of the Purchasing Agent, located in Room 401, City Hall, 27 West Main St., New Britain, Connecticut 06051, until **11:00 am on Wednesday, September 14, 2016**, and then at said office publicly opened and read aloud. The envelopes containing the bids must be sealed, addressed to the City of New Britain at the aforementioned address and designated as **Bids for AW Stanley Park and Aquatic Facilities Improvements, Bid No. 3896.**

The Owner may consider informal any bid not prepared and submitted in accordance with provisions hereof and may waive any informalities in or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered.

2. PREPARATION OF PROPOSAL

Proposals must be submitted on the prescribed forms included in the **Bid Proposal Submittal Package**, and any attachments as designated and necessary. All blank spaces must be filled in and all prompts answered. All responses shall be typewritten or hand printed in ink.

All bids must be completed on the **Form of Bid** included in the Bid Proposal Submittal Package, with the unit price for each item furnished in both words and figures, and the amount bid for each item furnished in figures. In addition, the total bid amount must be furnished in both words and figures. All prices and amounts shall be typewritten or hand printed in ink. The Bidder's attention is directed to the thirteen (13) stipulations set forth in the said Form of Bid and agreed to by the Bidder with his submittal of a bid for the subject project. All bids shall be subject to all requirements of the Bid Documents, including the Specifications, Drawings, any referenced documents, and these Instructions to Bidders. All bids must be regular in every respect and no interlineation, excisions or special conditions shall be made or included in the Bid Forms by the bidder.

Each bidder's proposal, including, completed in full, the Form of Bid, the Statement of Bidder's Qualifications, the Notary certificate, Certification(s) Regarding Equal Employment Opportunity, Certification of Non-segregated facilities, Prospective Vendor's Residency and Tax Payment Certificate, and the Bid Guaranty, and any other specifications pages requiring vendor response shall be enclosed in envelopes (outer and inner), both of which shall be sealed and clearly labeled with the words "**Bid Proposal", the**

bid number, the bidder's name, and the date and time of Bid Opening, in order to guard against premature opening of the Bid.
The Owner may consider as irregular any bid on which there is an alteration of or departure from the Bid Forms hereto attached and at its option may reject the same. The Owner reserves the right to reject any Bid submitted that is not in full compliance with these Instructions to Bidders as being not responsive. The Owner also reserves the right to reject the Bid of any Bidder it considers not responsible.

If the Contract is awarded, it will be awarded on the basis of the lowest bid and the selected Alternative and/or Optional Bid items, if any.

If forwarded by mail, the sealed envelope containing the proposal and marked as directed above, must be enclosed in another envelope addressed as specified in Article 1 of these Instructions to Bidders.

Erasures or other changes in the Bid Documents must be explained and noted over the signature of the Bidder.

3. BID DOCUMENTS

The Bid Documents for the Project shall consist of the following:

a) Bid Requirements and Conditions Document
b) Bid Proposal Submittal Document
c) Contract Drawings, Dated August 22, 2016, prepared by TLB Architecture, LLC
d) Project Manual and Technical Specifications, Dated August 22, 2016, prepared by TLB Architecture, LLC
e) New Britain Standard Specifications for Municipal Construction
f) Connecticut Department of Transportation Form 816, where so referenced (available from state of CT, Department of Transportation).

4. QUALIFICATIONS OF BIDDER

The Owner may make such investigations as he deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any and all bids if evidence submitted by or investigation of such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.

To assist the Owner in assessing the Bidder's ability to successfully perform the work, the Bidder shall complete in full the Statement of Bidder's Qualifications (pages SBQ-1 through SBQ-8) included in the Bid Proposal Submittal Package.

5. DISQUALIFICATION OF BIDDERS

More than one proposal from an individual, partnership, firm or corporation, or any association under the same or different names, will not be considered. Reasonable ground for believing that any bidder is interested in more than one proposal for the work contemplated will cause the rejection of all proposals in which such bidder is interested. Any or all proposals will be rejected if there is reason for believing that collusion exists among bidders, and all participants in such collusion will not be considered in future proposals for the same work.

6. BID SECURITY OR GUARANTY

Each bid must be accompanied by a bid bond or by a certified check of the bidder in the amount of TEN percent (10%) of the total bid amount, payable to the City of New Britain.

Such bonds or checks will be returned to all bidders, with the exception of the three lowest bidders, within three days after the formal opening of bids, and the remaining checks, or bid bonds, will be returned to the three lowest bidders within 48 hours after the Owner and the accepted bidder have executed the contract, or if no contract has been so executed, within 90 days after the date of opening of bids, or upon demand of the bidder at any time thereafter, so long as he has not been notified of the acceptance of his bid.

The bid must also be accompanied by a letter from an approved bonding company satisfactory to the Owner stating that said bonding company will bond the Contractor for one hundred percent (100%) of his total bid amount if said bidder shall be awarded the Contract for this project.

7. POWER OF ATTORNEY

Attorneys in fact who sign bid bonds or contract bonds must file with each bond a certified copy of their power of attorney to sign said bonds.

8. CONFLICT OF INTEREST

"No member, officer, or employee of the OWNER, or its designees or agents, no member of the governing body of the locality in which the program is situated, and no other public official of such locality or localities who exercises any function or responsibilities with respect to the program during the tenure, or for one year thereafter, shall have any interest, direct or indirect, in any contract or subcontract, or the proceeds thereof, under the agreement. The Grantee shall incorporate, or cause to be incorporated, in all such contracts or subcontracts a provision prohibiting such interest pursuant to the purposes of this article.

9. CONDITIONS OF WORK

Each bidder is responsible to inform himself fully of the conditions relating to the construction and labor under which the work is to be performed. Failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provisions set forth in his bid. Insofar as possible, work shall be performed in such a manner as not to conflict with, or adversely affect other contractors or individuals routine performance of their duties, or otherwise affected by the work.

10. OBLIGATION OF BIDDER AND INSPECTION OF SITE

Prior to bid submittal, it is the responsibility of each bidder to visit the project site and verify and become familiar with existing site conditions and other site attributes which may affect performance of the proposed work. It is also the bidder's responsibility to understand and be thoroughly familiar with the terms, obligations and requirements of the improvement plans, specification, and all other Bid Documents, and of all applicable City, State and Federal laws, codes, regulations, and requirements, and to make due allowance in his bid for all contingencies. Submittal of a Bid Proposal shall be considered conclusive evidence that the bidder has met these responsibilities. The failure or omission of any Bidder to receive or examine any form, instrument or documents shall in no way relieve any bidder from any obligation in respect to his bid.

If any omissions, errors, or other inconsistencies are noticed in the Bid Documents, it is the responsibility of the bidder to call them to the attention of Owner prior to bid submittal.

11. ENFORCEMENT OF TERMS AND CONDITIONS

The bidders are notified that all terms and conditions of the Contract and these Bid Documents will be rigidly enforced.

12. ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the plans, specifications or other Bid Documents will be made to any bidder orally. Every request for such interpretation should be made in writing addressed to the Owner, and, to be given consideration, must be received at least ten days prior to the scheduled bid opening. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Bid Documents which, if issued, will be mailed by CERTIFIED mail with return receipt requested to all prospective bidders (at the respective addresses furnished for such purpose) not later than five days prior to the scheduled bid opening. Failure of any bidder to receive any such addendum or interpretation shall not relieve any bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Bid Documents.

13. ALTERNATES AND SUBSTITUTIONS

If a bidder wishes to propose an alternate not listed in the Bid Documents, he is requested to state such alternate with his proposal in a conspicuous manner. The bidder's base bid shall be submitted based on the Bid Documents as issued; and a list of any proposed alternates or substitutions and the corresponding unit prices and total amounts to be added to, or deducted from, the base bid submitted separately.

14. WITHDRAWAL OF BIDS

The following procedure shall apply for withdrawal of bids. A bidder may withdraw the bid by submitting either a written or facsimile request of withdrawal to the owner. The request of withdrawal must be received by the owner before the scheduled bid opening and may be made by mail, facsimile or hand-delivery. The bid guarantee of any bidder withdrawing the bid in compliance with this section shall be returned.

15. REJECTION OF BIDS

A. The Owner may reject a bid if:

1. The bidder fails to furnish any of the information requested pursuant to Article 3A of these Instructions to Bidders;

2. The submitted Bid does not strictly conform to law or the requirements of the Bid Documents;

3. The submitted Bid is conditional or qualified;

4. The submitted Bid is determined, in the opinion of the Owner, to be unbalanced. An unbalanced bid is defined as a bid containing a unit price or lump sum amount for any item which is deemed unreasonable when considering the item by itself and not in conjunction with the bid as a whole or any other item, or items, contained therein.

5. The owner determines, by means of Article 3A of these Instructions to Bidders or any other appropriate means, the bidder to be not responsible, incompetent, or unqualified or incapable to perform the work specified.

B. The Owner, however, reserves the right to reject any or all bids, or part thereof, and to waive any informalities in a bid or the bidding process. The Owner also reserves the right to delete any of the bid items in total, or to reduce the quantity of the bid items, whenever it deems it is in the interest of the Owner to do so.

16. ACCEPTANCE AND AWARD OF CONTRACT

The Owner will accept one of the submitted bids on each contract, or will reject all bids on any or all contracts. Acceptance of the bid and Notice of Award will be in writing and signed the Owner or its designee, and mailed to the address designated in the successful bidder's proposal. The Notice shall contain information and instructions as to the time and place set for execution of the Contract. The successful bidder shall appear at the designated time and place to execute the Contract and furnish all bonds and certificates of insurance required.

17. METHOD OF AWARD - Lowest Responsible Bidder

Bids will be compared on the basis of the total Base Bid, plus Alternates accepted by the City. Alternates are not listed in priority order and shall be selected as deemed in the best interest of the City. Award will be made to the lowest responsible bidder, who shall be determined in accordance with and pursuant to Section 2-578 Items 1 through 12, inclusive, of the City of New Britain Code of Ordinances.

The City reserves the right to award two separate contracts or a single contract for both projects, as determined to be in the best interest of the City.

18. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

The successful bidder shall execute and deliver the contract and required bonds within 10 days after he has received notice of the acceptance of his bid. Failure or refusal to do so shall cause the bidder to forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his bid.

19. SECURITY FOR FAITHFUL PERFORMANCE

The bidder awarded the Contract shall, at the time of signing the Contract, submit an executed performance bond in the amount of 100% of the Contract amount conditioned upon the faithful performance of the Contract. Said performance bond shall be from a company or companies authorized to transact business in the State of Connecticut. The approved bonds shall also contain a labor and material bond for 100% of the Contract amount for the payment of all persons performing labor or furnishing materials in connection with this Contract.

20. SUBCONTRACTING

The successful bidder may utilize the services of specialty subcontractors on those portions of the work which, under normal contracting practices are performed by specialty subcontractors. The successful bidder shall not award any portion of the work to a

subcontractor without prior written approval of the Owner. The acceptance of any and all subcontractors shall reside with the Owner, and the Owner's decision shall be final. The successful bidder shall be fully responsible to the Owner for the performance, finished products, acts, and omissions of his subcontractors and persons directly or indirectly employed thereby.
The successful bidder shall cause appropriate provisions to be included in all subcontracts relative to this project to bind subcontractors to the provisions of the Contract and these Bid Documents as applicable to work performed by the subcontractor on this projects; and appropriate provisions to give the Owner the same powers and authority over any subcontractor as it has over the Contractor under the provisions of said documents.

21. WAGES AND SALARIES

Attention of the bidders is particularly called to the requirements concerning the payment of not less than the prevailing wage and salary rates as set forth by the State and Federal (if applicable) wage rates included in this Bid Requirements and Conditions Document (see the Table of Contents for location within the document), and the conditions of employment with respect to certain categories and classifications of employees included therein.

The rates of pay set forth are the minimum to be paid during the life of the Contract. It is therefore the responsibility of the bidders to inform themselves as to local labor conditions, such as the length of work day and work week, overtime compensation, health and welfare contributions, labor supply and prospective changes or adjustments of rates.

22. EQUAL EMPLOYMENT OPPORTUNITY

Attention of the bidders is called to the applicable State and Federal requirements for ensuring that employees and applicants for employment are not discriminated against because of their race, creed, color, or national origin.

23. EXECUTIVE ORDER No. 17

To comply with the Governor's Executive Order No. 17, the Contractor and any subcontractors holding a contract directly under the Contractor shall list all employment openings with the Connecticut State Employment Service. The Labor Commissioner may allow exceptions to listing of employment openings which the Contractor proposed to fill from within its organization with employees on the rolls of the Contractor on the date of publication of the invitation to bid, or the date on which the public announcement was published or promulgated advising of the program concerned.

24. LAWS AND REGULATIONS

The bidder's attention is directed to the fact that all applicable State and Municipal laws, rules, ordinances and regulations of all authorities having jurisdiction over construction work in the locality of the project shall apply to the contract throughout, and they are deemed to be included herein as if written out in full.

25. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

Time is of the essence and the renovations must be complete and operational in accordance with the following:

1. All work to the north of the existing pool fence line shall be completed no more than 180 calendar days from Notice to Proceed, with the goal of all final grading and planting be completed for the Spring 2017 planting season and the field ready for use by the 2017 summer camps.
2. All work to the south of the new pool bathhouse, inclusive of the access road, parking areas and basketball courts, shall be completed no more than 180 calendar days from Notice to Proceed, with the goal of all final grading and planting be completed for the Spring 2017 planting season and the field ready for use by the 2017 summer camps.
3. All work associated with the new swimming pool, bathhouse and maintenance building, as well as the demolition of the existing facilities and work associated with the baseball field and central parking lot shall be completed no later than 360 days calendar days from Notice to Proceed, with the goal of all final grading and planting be completed for the Fall 2017 planting season. Having the new bathhouse and pool operational by June 1, 2017 for the summer swim season would be preferred, but if not achievable, it is imperative that the existing pool remain fully operational for use in the summer of 2017.
4. See Contract and Form of Agreement for Contract requirements.

26. APPROVALS

The Contractor shall be responsible for obtaining all the necessary permits and approvals from the City of New Britain and the State of Connecticut, as required to complete the work in accordance with the improvement plans and other Contract Documents. The Owner will assist within its means in the approval process. However, any delays to the Contractor or the project, or any actions against either due to failure to obtain the necessary approvals, or to do so in a timely manner, or due to the Contractors lack of knowledge of the necessary approvals or the approval process, remain solely the responsibility of the Contractor.

27. START OF CONSTRUCTION

The successful bidder agrees to commence construction within ten (10) calendar days after receipt of the Notice to Proceed from the Owner. The Notice to Proceed shall be sent by the Owner after execution and delivery of the Contract and required bonds in accordance with Article 7 of these Instructions to Bidders.

28. REFERENCE SPECIFICATIONS

A. The most recent edition of the "City of New Britain Standard Specifications for Municipal Construction" (also referred to as "Standard Specifications") is hereby made a part of these Bid Documents and the ensuing Contract by reference. Copies of the Standard Specifications are available for review and purchase from the New Britain Bureau of Engineering.

B. Where referenced, the State of Connecticut Department of Transportation "Standard Specifications for Roads, Bridges and Incidental Construction, Form 816" with latest Supplemental Specifications, (also referred to as "Form 816"), is hereby made a part of these Bid Documents and the ensuing Contract by reference. Copies of Form 816 are available for purchase from the D.O.T., and copies are available for review at the New Britain Bureau of Engineering.

29. CONFLICTING PROVISIONS

In the event of conflicts or inconsistencies between separate provisions of these Bid Documents and/or the executed Contract, such conflicts shall be resolved by applying the following in decreasing order of precedence:

Contractual Matters	Technical Matters
1) Contract-Form of Agreement	1) Special Technical Specifications
2) Invitation to Bid	2) Contract Drawings
3) Instructions to Bidders	3) Reference Specifications
4) Special Provisions	
5) Supplemental General Conditions	
6) General Conditions	

30. SAFETY AND HEALTH REGULATIONS

These construction documents, and the joint and several phases of construction hereby contemplated are to be governed at all times, by applicable provisions of the federal law(s), including but not limited to, the latest amendments of the following:

(1) William-Steiger Occupational Safety and Health Act of 1970, Public Law 91-956;

(2) Part 1910 - Occupational Safety and Health Standards, Chapter SVII of Title 29, Code of Federal Regulations;

(3) Part 1926 (formerly Part 1518) - Safety and Health Regulations for Construction, Chapter XIII of Title 29, Code of Federal Regulations.

In the event of any inconsistencies between the above laws and regulations and the provisions of these documents, the laws and regulations shall prevail.

31. SALES TAX

The Owner is exempt from Connecticut State Sales and Use Taxes on materials and equipment to be incorporated in this work. The Contractor may purchase materials or supplies to be consumed in the performance of this contract without payment of tax and shall not include taxes in his Contract Price.

32. SOURCE OF MATERIALS

CT DOT Form CON-083, "Anticipated Source of Materials", pages ASM-1 and ASM-2, of the Bid Proposal Submittal Document shall be completed in full by the apparent low bidder and submitted to the Engineer prior to Award of the Contract.

STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires.

1. Name of Bidder

   1A. Corporation __
   Partnership __
   Individual __
   Joint Venture __
   Other __
   (Check One)

2. Bidder's FEDERAL Tax Identification Number.

3. Permanent main office address, telephone number(s) and fax number(s).

4. Date organized?

5. If a corporation, answer the following:

   5.1 Date of incorporation:
   5.2 State of incorporation:
   5.3 President's name:
   5.4 Vice-President's name(s):

   5.5 Secretary's name:
   5.6 Treasurer's name:

6. If a partnership, answer the following:

   6.1 Date of organization:
   6.2 Name and address of all partners (State whether general or limited partnership):

7. If other than a corporation or partnership, describe organization and name principals:

8. How many years have you been engaged in construction under your present firm or trade name?

   8.1 Under what other or former names has your organization operated?

9. Contracts on hand:(Schedule these, showing name of project, owner, architect and/or engineer, gross amount of each contract, percent complete and the scheduled dates of completion).

   9a. Please provide company name, address, telephone number and contact person for at least two installations which you have completed similar in complexity and facility usage to that which you are proposing in response to Public Bid XXXX that have been in service for at least three years.

10. General character of work performed by you and work normally performed with your own forces:

11. Have you ever failed to complete any work awarded to you? If so, note when, where, why:

12. Within the last five years, has any officer or partner of your organization ever been an officer or partner of another organization when it failed to complete a construction contract? If so, attach a separate sheet of explanation.

13. Have you ever defaulted on a contract? If so, where and why?

14. List the major projects your organization has completed in the past five years, giving the name of project, owner, architect and/or engineer, contract amount, date of completion, and percentage of the cost of the work performed with your own forces.

15. List your major equipment <u>available for this contract</u>, stating which is owned and which will be leased.

16. Experience in work similar in importance to this project and when completed by you.

17. State the number of years of background and experience of the principal members of your organization, including the officers and the nature of business activity.

18. Trade References:

19. Give Bank references and credit available $_____.

20. Name of Bonding Company and name and address of agent:

21. Attach a financial statement, audited if available, including Contractor's latest balance sheet and income statement showing the following items:

A. Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials, inventory and prepaid expenses):

B. Net fixed assets:

C. Other assets:

D. Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries, and accrued payroll taxes):

E. Other liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus, and retained earnings):

F. Name and address of firm preparing financial statement and date thereof:

21.1 Is this financial statement for the identical organization named in #1?

If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

21.2 Will this organization act as guarantor of the contract for construction?

Note regarding financial Statement:

The Bidder financial information will be maintained in confidence pursuant to C.G.S. provision Section 1-19(b)(5), provided that:

a. Bidder clearly indicates in writing a request that the financial information be maintained in confidence by the City of New Britain; and,

b. Submission of financial information is made in a separate, sealed envelope clearly marked "Financial Information - to be maintained in confidence".

22. Will you, upon request, furnish any other information that may be required by the City of New Britain?

23. The undersigned hereby authorizes and requests any persons, firms, or corporations to furnish any information requested by the City of New Britain in verification of the recitals comprising this Statement of Bidder's Qualifications.

Dated this _____ day of _____ , 2016

Bidder's Name: _____

By: _____ Official Address:

Title: _____ _____

(**Note:** the above signature must be notarized on following page.)

NOTARY'S CERTIFICATE:

STATE OF _____)
)
COUNTY OF _____)

_____ , being duly sworn,
deposes and says that he is _____ of
_____ , and that the
answers to the foregoing questions and all statements therein are
true and correct.
Subscribed and sworn before me this ___ day of_____,
2007.

Notary Public
My Commission Expires:

PROSPECTIVE VENDOR'S RESIDENCY
AND TAX PAYMENT CERTIFICATION

The City of New Britain Code of Ordinances, Sec. 2-575, reads as follows:

> **Sec. 2-575. Rejection of bid where bidder is in default to City**
>
> **The agent shall not accept the bid of a contractor who is in default on the payment of taxes, licenses or other monies due the city.**
>
> **The agent shall include in the bid document a form to be executed by a bidder certifying that said bidder is not in default on the payment of taxes, licenses or other monies due the city.**
>
> **As used in this section, (1) a "principal" of a contractor shall mean an individual who is a director, an officer, an owner, a limited partner, or a general partner; and (2) "default in the payment of taxes" shall mean failure to pay taxes by the date such taxes are due and payable or the failure to be current with respect to a delinquent taxes payment schedule as set forth in a written agreement with the Tax Collector.**

In accordance with this provision, the prospective vendor submitting the accompanying bid for City of New Britain **Bid No. 3896** hereby makes the following certifications with respect to the residencies of his firm and the principals thereof:

Firm Name:

Complete Business Address
of Submitting Office:

_____

Complete Business Address
of Main Office (if different):

_____

The persons listed on the following pages (make and use additional copies of page "RTC-2__ of 3", if necessary, filling in the "__" in the page number and before the name as appropriate,) including their residency address, and all other requested information, represent all of the principals, as defined previously herein, of the above-named prospective vendor:

1. Name: _____

Residency Address:

_____

Mailing Address (if different):

_____

List below the addresses of any (other) properties located within the City of New Britain which the above-named principal owns in whole or in part, or otherwise has an interest in; reply with 'none' if applicable:

_____

_____

List below the names and addresses of any (other) business entities using a New Britain address of which the above-named principal is also a principal; reply with 'none' if applicable:

_____

_____

2. Name: _____

Residency Address:

_____

Mailing Address (if different):

_____

List below the addresses of any (other) properties located within the City of New Britain which the above-named principal owns in whole or in part, or otherwise has an interest in; reply with 'none' if applicable:

_____

_____

List below the names and addresses of any (other) business entities using a New Britain address of which the above-named principal is also a principal; reply with 'none' if applicable:

_____

_____

3. Name: _____

Residency Address:

_____

Mailing Address (if different):

_____

List below the addresses of any (other) properties located within the City of New Britain which the above-named principal owns in whole or in part, or otherwise has an interest in; reply with 'none' if applicable:

_____

_____

List below the names and addresses of any (other) business entities using a New Britain address of which the above-named principal is also a principal; reply with 'none' if applicable:

_____

_____

CERTIFICATION IS HEREBY MADE THAT _____
(The prospective vendor named above) AND THE _____ (total number of principals) PRINCIPALS THEREOF, AS LISTED HEREIN, ARE NOT IN DEFAULT ON PAYMENT OF TAXES, LICENSES, OR OTHER MONIES DUE THE CITY OF NEW BRITAIN AS OF THE DATE OF BID SOLICITATION.

Signature and Title of authorized principal of named prospective vendor: Date:

_____ _____

Review by Tax Collector (to be completed for successful bidder only):

Signature of Tax Official: Date:

_____ _____

CERTIFICATION OF NONSEGREGATED FACILITIES

This Bidder certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The Bidder certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The Bidder agrees that a breach of his certification will be a violation of the Equal Opportunity clause in any Contract resulting from acceptance of his Bid. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are, in fact, segregated on the basis of race, color, religion or natural origin, because of habit, local custom or otherwise. The Bidder agrees that (except where he has obtained identical certification from proposed Subcontractors for specific time periods) he will obtain identical certifications from proposed Subcontractors prior to the award of Subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his files.

Date: _____ Signed:_____

Title: _____

CERTIFICATION OF BIDDER REGARDING EQUAL EMPLOYMENT OPPORTUNITY

INSTRUCTIONS

This certification is required pursuant to Executive Order 11246 (30 F. R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or sub-contract subject to the equal opportunity clause; and, if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the bidder has not filed a compliance report due under applicable instructions, such bidder shall be required to submit a compliance report within seven calendar days after bid opening. No contract shall be awarded unless such report is submitted.

CERTIFICATION BY BIDDER

Bidder's Name: _____

Address and Zip Code: _____

_____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.
   Yes No (If answer is yes, identify the most recent contract.)

2. Compliance reports were required to be filed in connection with such contract or subcontractor.
   Yes No (If answer is yes, identify the most recent contract.)

3. Bidder has filed all compliance reports due under applicable instructions, including SF-100.
   Yes No None Required

4. If answer to item 3 is "No", please explain in detail on reverse side of this certification.

Certification - The information above is true and complete to the best of my knowledge and belief.

Name and Title of Signer (Please Type) _____

_____ _____
Signature Date

CERTIFICATION BY PROPOSED SUBCONTRACTOR REGARDING EQUAL EMPLOYMENT OPPORTUNITY

NAME OF PRIME CONTRACTOR _____BID NO. XXXX

INSTRUCTIONS

This certification is required pursuant to Executive Order 11246 (30 F.R. 12319-25). The implementing rules and regulations provide that any bidder or prospective contractor, or any of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or sub-contract subject to the equal opportunity clause; and, if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the subcontractor has not filed a compliance report due under applicable instructions, such subcontractor shall be required to submit a compliance report before the owner approves the subcontract or permits work to begin under the subcontract.

SUBCONTRACTOR'S CERTIFICATION

Subcontractor's Name: _____

Address: _____

_____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.
   Yes No

2. Compliance reports were required to be filed in connection with such contract or subcontract.
   Yes No

3. Bidder has filed all compliance reports due under applicable instructions, including SF-100.
   Yes No None Required

4. If answer to item 3 is "No", please explain in detail on reverse side of this certification.

Certification - The information above is true and complete to the best of my knowledge and belief.

NAME AND TITLE OF SIGNER (Please Type) _____

_____
SIGNATURE DATE

BID FORM – City Bid Number 3896
AW Stanley Park and Aquatic Facilities Improvements, New Britain, CT

The undersigned bidder hereby submits the following bid for the **AW Stanley Park and Aquatic Facilities Improvements, New Britain, CT,** in accordance with the Bid Documents, dated August 22, 2016, for said project. The undersigned has carefully examined and understands all Bid Documents and Contract Requirements and has complied with all the provisions thereof in the preparation of the bid. The Undersigned also offers to furnish all plant, labor, material, supplies, equipment and other facilities for or incidental to the construction of said project as required by, and in strict accordance with, the Drawings, Specifications, Project Manual, and all addenda issued by the Owner.

The Bid must be written in words and figures for the Base Bid(s) and Unit Price Bids.

The undersigned bidder acknowledges receipt of the following:

Addendum #	Date	Acknowledged
_____	_____	_____
_____	_____	_____

The Bid Form begins on the next Page.

The total amount of the bid based on the Contract Documents shown herein and as computed by the undersigned Bidder for the **AW Stanley Park and Aquatic Facilities Improvements,** is:

Base Bid:

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____

Unit Price # 1 (Replace Unsatisfactory Soils; per cubic yard):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / CY

TOTAL AMOUNT BID IN FIGURES: $_____/ CY

Unit Price # 2 (Rock Excavation and Backfill; per cubic yard):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / CY

TOTAL AMOUNT BID IN FIGURES: $_____/ CY

Unit Price # 3 (Shade Structure, Type 'A'; per each):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / Each

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Unit Price # 4 (Shade Structure, Type 'B'; per each):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / Each

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Unit Price # 5 (Park Bench; per each):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / Each

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Unit Price # 6 (Trash / Recycling Receptacle; per each):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / Each

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Unit Price # 7 (Bike Rack; per each):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / Each

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 1 (Overlook):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 2 (Upgrade Gravel Turnaround to Pavement):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 3 (Playscape Surfacing and Underdrainage):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 4 (Additional Gravel Parking):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate #5 (Resurface Gravel Lot near Chalet):

TOTAL AMOUNT BID IN WORDS:

_____DOLLARS / Each

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 6 (Lawn Seating and Concrete Walks):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 7 (Selective Plantings):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 8 (Selective Timber Guiderails):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 9 (East Climbing Wall):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 10 (West Climbing Wall):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

Alternate # 11 (Bathhouse Dormers):

TOTAL AMOUNT BID IN WORDS:

_____ DOLLARS

TOTAL AMOUNT BID IN FIGURES: $_____/ Each

It is understood and agreed to by the bidder that:

1) The itemization of the Bid, and the selection of the Bid Items used therein, is at the Owner's discretion, and solely for the Owner's convenience in evaluating and comparing the submitted bids and administering the Contract.

2) The Unit Price bid for each item, and the aggregate sum of the Unit Prices multiplied by the corresponding estimated quantity as applied to the project as a whole, includes all plant, labor, material, supplies, equipment, and other facilities necessary for, and incidental to, the construction of

said item, complete, fully functional, and properly finished, as required by, and in strict conformance with these Bid Documents, and for the use (or uses) and appearance intended by the Owner.

3) The price bid per unit quantity of work in the various items above shall control in contract award herein.

4) The quantities noted above are approximate, only being estimated solely for use in comparing bids.

5) The Total Bid Amounts entered above, and the bid amount for each item (obtained by multiplying the unit price by the estimated quantity), are included solely for the purpose of checking this proposal and for the convenience of the Bidder.

6) The above prices are to be paid for the actual quantities of the items of work in the completed work or structure. Should the dimensions of any part of the work or the quantities of materials used or work performed be different than those designated in this Form of Bid, or on the Improvement Drawings, the actual quantities only will be allowed in measurement.

7) In submitting this Bid, the Bidder understands that the Owner reserves the right to reject any and all bids, and to waive any informality in the bidding. The Owner further reserves the right to make the award on the basis of the above bid.

8) If written notice of the acceptance of this bid is mailed, telegraphed, or delivered to the undersigned after the opening thereof, the undersigned agrees to execute and deliver any Agreement in the prescribed form and furnish the required bonds within ten (10) days after the Agreement is presented to him for his signature.

9) The Bidder is enclosing a statement of his qualifications.

10) The Owner reserves the right to delete any of the bid items in total or to increase or reduce the quantity of any bid items.

11) The Bidder shall comply with all provisions of the Bid Documents in his prosecution of the Project if awarded the Contract; and all provisions will be enforced by the Owner.

Company Name: _____

Official Address: _____

_____

Company Phone Number: _____

Contact Person Name: _____

Contact Person Email: _____

Dated this _____ day of _____ , _____

By: _____

Official Signature: _____

Title: _____

Dated this ____ day of _____ , 2014

Sample Bid Bond Begins on Next Page

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned,

_____, as Principal, and _____ _____,

as Surety, are hereby held and firmly bound unto The City of New Britain, as Owner, in the penal sum of

_____ Dollars ($_____) lawful money of the United States, for the payment of which sum well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns firmly by these presents.

The condition of the above obligation is such that whereas the Principal has submitted to the Owner a certain Bid, attached hereto, and made a part hereof by reference, to enter into a contract in writing for the project entitled:

Public Bid No. 3896

NOW THEREFORE,

(a) if said Bid shall be rejected, or in the alternate,

(b) if said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract (properly completed in accordance with said Bid) attached hereto, and shall furnish the Owner with proper bonds for his faithful performance of said contract and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void. Otherwise, the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of his obligation as herein stated.

The surety, for value received, hereby stipulates and agrees that the obligation of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporation seals to be hereto affixed, and these presents to be signed by their proper officers.

Made and entered into this ___ day of _____ , 2016

PRINCIPAL:

By: _____

SURETY:

By: _____

Form **W-9**
(Rev. January 2011)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give Form to the requester. Do not send to the IRS.

Print or type
See Specific Instructions on page 2.

Name (as shown on your income tax return)

Business name/disregarded entity name, if different from above

Check appropriate box for federal tax classification (required): ☐ Individual/sole proprietor ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶

☐ Other (see instructions) ▶

☐ Exempt payee

Address (number, street, and apt. or suite no.)

Requester's name and address (optional)

City, state, and ZIP code

List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Social security number

			–			–				

Employer identification number

		–							

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below).

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 4.

Sign Here | **Signature of U.S. person ▶** | **Date ▶**

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income.

Note. If a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien,
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
- An estate (other than a foreign estate), or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax on any foreign partners' share of income from such business. Further, in certain cases where a Form W-9 has not been received, a partnership is required to presume that a partner is a foreign person, and pay the withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid withholding on your share of partnership income.

The person who gives Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States is in the following cases:

- The U.S. owner of a disregarded entity and not the entity,
- The U.S. grantor or other owner of a grantor trust and not the trust, and
- The U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person, do not use Form W-9. Instead, use the appropriate Form W-8 (see Publication 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items:

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.
2. The treaty article addressing the income.
3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.
4. The type and amount of income that qualifies for the exemption from tax.
5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity not subject to backup withholding, give the requester the appropriate completed Form W-8.

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS a percentage of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,
2. You do not certify your TIN when required (see the Part II instructions on page 3 for details),
3. The IRS tells the requester that you furnished an incorrect TIN,
4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or
5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See the instructions below and the separate Instructions for the Requester of Form W-9.

Also see *Special rules for partnerships* on page 1.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account, for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of $50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a $500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Name

If you are an individual, you must generally enter the name shown on your income tax return. However, if you have changed your last name, for instance, due to marriage without informing the Social Security Administration of the name change, enter your first name, the last name shown on your social security card, and your new last name.

If the account is in joint names, list first, and then circle, the name of the person or entity whose number you entered in Part I of the form.

Sole proprietor. Enter your individual name as shown on your income tax return on the "Name" line. You may enter your business, trade, or "doing business as (DBA)" name on the "Business name/disregarded entity name" line.

Partnership, C Corporation, or S Corporation. Enter the entity's name on the "Name" line and any business, trade, or "doing business as (DBA) name" on the "Business name/disregarded entity name" line.

Disregarded entity. Enter the owner's name on the "Name" line. The name of the entity entered on the "Name" line should never be a disregarded entity. The name on the "Name" line must be the name shown on the income tax return on which the income will be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a domestic owner, the domestic owner's name is required to be provided on the "Name" line. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on the "Business name/disregarded entity name" line. If the owner of the disregarded entity is a foreign person, you must complete an appropriate Form W-8.

Note. Check the appropriate box for the federal tax classification of the person whose name is entered on the "Name" line (Individual/sole proprietor, Partnership, C Corporation, S Corporation, Trust/estate).

Limited Liability Company (LLC). If the person identified on the "Name" line is an LLC, check the "Limited liability company" box only and enter the appropriate code for the tax classification in the space provided. If you are an LLC that is treated as a partnership for federal tax purposes, enter "P" for partnership. If you are an LLC that has filed a Form 8832 or a Form 2553 to be taxed as a corporation, enter "C" for C corporation or "S" for S corporation. If you are an LLC that is disregarded as an entity separate from its owner under Regulation section 301.7701-3 (except for employment and excise tax), do not check the LLC box unless the owner of the LLC (required to be identified on the "Name" line) is another LLC that is not disregarded for federal tax purposes. If the LLC is disregarded as an entity separate from its owner, enter the appropriate tax classification of the owner identified on the "Name" line.

Other entities. Enter your business name as shown on required federal tax documents on the "Name" line. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on the "Business name/ disregarded entity name" line.

Exempt Payee

If you are exempt from backup withholding, enter your name as described above and check the appropriate box for your status, then check the "Exempt payee" box in the line following the "Business name/ disregarded entity name," sign and date the form.

Generally, individuals (including sole proprietors) are not exempt from backup withholding. Corporations are exempt from backup withholding for certain payments, such as interest and dividends.

Note. If you are exempt from backup withholding, you should still complete this form to avoid possible erroneous backup withholding.

The following payees are exempt from backup withholding:

1. An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2),

2. The United States or any of its agencies or instrumentalities,

3. A state, the District of Columbia, a possession of the United States, or any of their political subdivisions or instrumentalities,

4. A foreign government or any of its political subdivisions, agencies, or instrumentalities, or

5. An international organization or any of its agencies or instrumentalities.

Other payees that may be exempt from backup withholding include:

6. A corporation,

7. A foreign central bank of issue,

8. A dealer in securities or commodities required to register in the United States, the District of Columbia, or a possession of the United States,

9. A futures commission merchant registered with the Commodity Futures Trading Commission,

10. A real estate investment trust,

11. An entity registered at all times during the tax year under the Investment Company Act of 1940,

12. A common trust fund operated by a bank under section 584(a),

13. A financial institution,

14. A middleman known in the investment community as a nominee or custodian, or

15. A trust exempt from tax under section 664 or described in section 4947.

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 15.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 9
Broker transactions	Exempt payees 1 through 5 and 7 through 13. Also, C corporations.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 5
Payments over $600 required to be reported and direct sales over $5,000 [1]	Generally, exempt payees 1 through 7 [2]

[1] See Form 1099-MISC, Miscellaneous Income, and its instructions.

[2] However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney, and payments for services paid by a federal executive agency.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN. However, the IRS prefers that you use your SSN.

If you are a single-member LLC that is disregarded as an entity separate from its owner (see *Limited Liability Company (LLC)* on page 2), enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note. See the chart on page 4 for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local Social Security Administration office or get this form online at *www.ssa.gov*. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at *www.irs.gov/businesses* and clicking on Employer Identification Number (EIN) under Starting a Business. You can get Forms W-7 and SS-4 from the IRS by visiting IRS.gov or by calling 1-800-TAX-FORM (1-800-829-3676).

If you are asked to complete Form W-9 but do not have a TIN, write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note. Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: *A disregarded domestic entity that has a foreign owner must use the appropriate Form W-8.*

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, below, and items 4 and 5 on page 4 indicate otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on the "Name" line must sign. Exempt payees, see *Exempt Payee* on page 3.

Signature requirements. Complete the certification as indicated in items 1 through 3, below, and items 4 and 5 on page 4.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account)	The actual owner of the account or, if combined funds, the first individual on the account [1]
3. Custodian account of a minor (Uniform Gift to Minors Act)	The minor [2]
4. a. The usual revocable savings trust (grantor is also trustee)	The grantor-trustee [1]
b. So-called trust account that is not a legal or valid trust under state law	The actual owner [1]
5. Sole proprietorship or disregarded entity owned by an individual	The owner [3]
6. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulation section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	**Give name and EIN of:**
7. Disregarded entity not owned by an individual	The owner
8. A valid trust, estate, or pension trust	Legal entity [4]
9. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
10. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
11. Partnership or multi-member LLC	The partnership
12. A broker or registered nominee	The broker or nominee
13. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
14. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulation section 1.671-4(b)(2)(i)(B))	The trust

[1] List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

[2] Circle the minor's name and furnish the minor's SSN.

[3] You must show your individual name and you may also enter your business or "DBA" name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

[4] List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships* on page 1.

***Note.** Grantor also must provide a Form W-9 to trustee of trust.

Note. If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records from Identity Theft

Identity theft occurs when someone uses your personal information such as your name, social security number (SSN), or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Publication 4535, Identity Theft Prevention and Victim Assistance.

Victims of identity theft who are experiencing economic harm or a system problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes. Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to *phishing@irs.gov*. You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at: *spam@uce.gov* or contact them at *www.ftc.gov/idtheft* or 1-877-IDTHEFT (1-877-438-4338).

Visit IRS.gov to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

NON COLLUSIVE AFFIDAVIT OF BIDDERS

BID# 3896– AW Stanley Park and Aquatic Facilities Improvements

State of (_____);

County of (_____).

I state that I am the _____ of _____
(title) (name of firm)

and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the price(s) and the amount of this Bid.

I certify that:

(1) The price and amount on this Bid has been arrived at independently and without consultation, communication, or agreement with any other bidder.
(2) Neither the price(s) nor the amount of this Bid and approximate price(s) nor approximate amount of this Bid has been disclosed to any other firm or person who is a Bidder and that no disclosure of these items will be made prior to the Bid opening.
(3) No attempt has been or will be made to induce any firm or person to refrain from proposing on this Bid, or to submit a Bid higher that this Bid, or to submit any intentionally higher or non competitive Bid.
(4) Neither the said Bidder nor any of its officers, partners, owners, representatives, employees or parties in interest, including this affidavit, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from Bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the City of New Britain, owner, or any person interested in the proposed Contact.
(5) The Bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other non competitive proposal.

(6) I state that _____understands and acknowledges that all
(name of my firm)
representations of this affidavit are material and important, and will be relied on by the City of New Britain in awarding a contract for which this is submitted. I understand and my firm understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from the City of New Britain of the true facts relating to the submission of Bids for this contract. That the City of New Britain also reserves the right to reject our Bid if failure to complete this document, have it notarized and submitted with our Bid documents.

The undersigned Bidder further certifies that this statement is executed for the purpose of including the City of New Britain to consider the Bid and make an award in accordance therewith.

Subscribe and Sworn to me this

_____day of _____, 2014

_____

_____

Notary Public
My Commission Expires

_____

_____
Legal Name of Bidder

_____
Business Address

_____
Signature and Title of Person

_____
Date

NCAF-1

FORM OF AGREEMENT BETWEEN CONTRACTOR AND OWNER

THIS AGREEMENT, made the ___ day of _____in the year **TWO THOUSAND and SIXTEEN** by and between THE CITY OF NEW BRITAIN, hereinafter called the "OWNER" and _____ _____, hereinafter called the "CONTRACTOR".

WHEREAS, the City is desirous of entering into a contract for the AW Stanley Park and Aquatic Facilities Improvements, in the City of New Britain Connecticut,

WHEREAS, the Contractor has entered a bid price and is adjudged the successful bidder, for the AW Stanley Park and Aquatic Facilities Improvements and facility Renovations, in the City of New Britain, Connecticut.

WITNESSETH THAT, the Contractor and the Owner for the considerations hereinafter named agree as follows:

Article 1. SCOPE OF WORK~ The Contractor shall furnish all of the materials and perform all of the work shown on the drawings and described in the specifications prepared by the City of New Britain as and in these Contract Documents prepared by TLB Architecture, LLC and entitled the "AW Stanley Park and Aquatic Facilities Improvements", August 22, 2016; **City Bid No. 3896** and shall do everything required by the Contract Documents as designated in Article 3 of this Agreement.

Article 2. THE CONTRACT PRICE~ The Owner will pay the contractor for the performance of the Contract in current funds, for the total quantities of work performed at the unit prices stipulated in the Bid for the several respective items of work completed subject to additions and deductions as provided in the Section entitled "Changes in the Work" under the General Conditions."

Article 3. CONTRACT~ The executed contract documents shall consist of the following:

a. This Agreement
b. Addenda thereto:

No. __ date _____ No. __ date _____ No. __ date

c. Bid Requirements and Conditions Document
d. Bid Proposal Submittal Document, as submitted by Contractor
e. Improvement Plans
f. Other Contract Drawings issued
g. Special Technical Specifications
h. New Britain Standard Specifications for Municipal Construction
i. Connecticut Department of Transportation Form 816

This Agreement, together with the other documents enumerated in this Article 3 and other documents which are made part hereof by reference, forms the Contract between the parties hereto.

The Contractor and the Owner for themselves, their successors, executors and administrators and assigns hereby agree to the full performance of the covenants herein contained.

Article 4. NOTICE TO PROCEED, TIME OF COMPLETION, AND LIQUIDATED DAMAGES:- The Contractor shall agree to commence work within ten (10) calendar days after receipt of the "Notice to Proceed" from the Owner. Such Notice may be sent after execution of this Agreement (also referred to herein as the "Contract").

The Contractor shall agree to complete the work as follows:

1. All work to the north of the existing pool fence line shall be completed no more than 180 calendar days from Notice to Proceed, with the goal of all final grading and planting be completed for the Spring 2017 planting season and the field ready for use by the 2017 summer camps.
2. All work to the south of the new pool bathhouse, inclusive of the access road, parking areas and basketball courts, shall be completed no more than 180 calendar days from Notice to Proceed, with the goal of all final grading and planting be completed for the Spring 2017 planting season and the field ready for use by the 2017 summer camps.
3. All work associated with the new swimming pool, bathhouse and maintenance building, as well as the demolition of the existing facilities and work associated with the baseball field and central parking lot shall be completed no later than 360 days calendar days from Notice to Proceed, with the goal of all final grading and planting be completed for the Fall 2017 planting season. Having the new bathhouse and pool operational by June 1, 2017 for the summer swim season would be preferred, but if not achievable, it is imperative that the existing pool remain fully operational for use in the summer of 2017.

The date of completion shall be known as the "Date of Substantial Completion" when all construction is sufficiently complete in accordance with the Contract Documents, so the owner can occupy or utilize the work or designated portion thereof for the use which it is intended, and the work is properly finished to provide the appearance intended, and the Certificate of Completion is issued by the Owner to the Contractor.

The Contractor shall prosecute the work continuously until completion. The rate of progress for any given Phase shall be at least that shown on the “Schedule of Progress” which is to be submitted to the Engineer by the Contractor in a form satisfactory to the Engineer prior to execution of this Agreement.

In general, work shall be prosecuted continuously throughout the term of the Contract, including the winter season. The Contractor will be expected to keep work going whenever possible. The Engineer will determine when conditions are unfavorable for work, or for any portion thereof, and may order that work be suspended on any part or all portions of the Contract whenever, in his opinion, the conditions are not such as will insure first class work.

The Contractor shall further agree that the Date of Completion of the Project Work is a reasonable time for completion of the work contemplated in accordance with the Improvement Plans, Specifications, and other Contract Documents, taking into consideration average weather conditions, availability of labor and delivery of materials and equipment.

If the Contractor neglects, fails or refuses to substantially complete the Project Work within the Time of Completion as specified herein, or any proper extension granted thereto by the Owner in accordance with the General Conditions, then the Contractor shall agree, as part consideration for the

award of this Contract, to pay to the Owner a liquidated damage for breach of contract for **each and every calendar day** that the Contractor shall be in default on the subject Phase. This is not to be construed in any sense as a penalty.

Where actual damages for any delay in substantial completion of a Phase are impossible to determine by reason of the Owner's election not to terminate the right of the Contractor to proceed, the Contractor and his sureties shall be liable for, and shall pay to the Owner, the sum of **Four Hundred Fifty Dollars ($450)**, as fixed, agreed, and liquidated damages for **each calendar day** of such delay until the work is substantially completed and accepted.

The Owner, however, may accept the work if there has been such a degree of completion as will, in the Owner's opinion, make the project reasonably safe, fit, and convenient for the use and accommodation for which it was intended. In such case, the Contractor shall not be charged with liquidated damages, but the Owner may assess the actual damages by such delay.

Article 5. GUARANTEE:- The Contractor guarantees the work done under this contract and the materials furnished by him and used in the work are free from defects, and the guarantee is for a term of **one year** from and after the date of the **Certificate of Project Completion**. It is agreed and understood that the Contractor will at any time during this one year period, upon notification in writing from the Engineer, and without expense to the Owner, immediately execute all repairs which may be necessitated, as determined by the Engineer, by reason of any defective materials used therein, or by defective workmanship, or by reason of the normal use or functioning of all facilities constructed under this contract.

The Owner reserves the right to retain up to five percent (5%) of the Total Contract Price, or to accept, at the Owner's option, a Guarantee Bond for up to five percent (5%) of the Total Contract Price, and to hold such retainage or bond for the duration of the guarantee period. Upon expiration of the guarantee period, provided that all work is in good order, the Contractor shall be entitled to receive said retainage or, if posted, the release of the Guarantee Bond.

The Contractor must provide to the Owner at the time of signing this contract Performance and Material Bonds and Certificate of Insurance for this project.

Article 6. PREVAILING WAGE RATES: Prevailing Wage Rates do apply for this project. The Contractor will submit weekly a copy of all payrolls to the Owner. The copy shall be accompanied by a statement signed by the Owner or his agent indicating that the payrolls are correct and complete, that the wage rates contained therein are not less than those determined by the Connecticut Department of Labor and that of the Owner's prevailing wage rates for this project in accordance with the specifications, conditions, and bid terms of Bid #3764.

Article 7. INSURANCE COVERAGE: The Contractor shall agree to maintain in force at all times during which services are to be performed the following coverages placed with company(ies) licensed by the State of Connecticut which have at least an "A-VIII" policyholders' rating according to BEST Publications latest edition Key Rating Guide:

Commercial General Liability:	General Aggregate	$ 2,000,000
	Prod./Compl. Operations Aggregate	$ 2,000,000
	Occ. Aggregate	$ 1,000,000
	Liability Limit	$ 1,000,000

Automobile Liability:		
Umbrella	Each Occurrence	$1,000,000
(Excess Liability)	Aggregate	$1,000,000
Workers' Comp. And	WC Statutory Limits	
Employer's Liability:	EL Each Accident	$500,000
	EL Disease Each Employee	$500,000
	EL Disease Policy Limit	$500,000

The City of New Britain and Consolidated School District" shall be named as "Additional Insured", and the Contractor agrees to provide replacement/renewal certificate at least 60 days prior to the expiration of the policy. Should any of the described policies be cancelled before the expiration date, written notice must be made to the City 30 days prior to cancellation.

The Contractor agrees to provide a certificate of insurance at the time of the execution of this contract as was as a replacement/renewal certificate at least 60 days prior to the expiration of the policy. Should any of the above-described policies be cancelled before the expiration date, written notice must be made to the City 30 days prior to cancellation. The Contractor also agrees to the City as Additional Insured on all Insurance Polices except Workers Compensation and to provide the City a Waiver of Subrogation on all Insurance Policies.

If any policy is written on a "Claims Made" basis, the policy must be continually renewed for a minimum of two (2) years from the completion date of this contract. If the policy is replaced and/or the retroactive date changed, then the expiring policy must be endorsed to extend the reporting period for claims for the policy in effect during the contract for two (2) years from the completion date.

Contractor covenants and agrees to hold the City harmless and to indemnify the City from (I) any and all claims arising from the performance of service enumerated herein, or any work or thing whatsoever done, or any condition created (other than by the City)during the term of this contract or any extensions thereof, but only to the extent caused by the negligent or otherwise wrongful act or omission of Contractor, its agent, employees, contractors or licensees and (II) all costs, expenses, liabilities incurred in or in connection with each such claim or action or proceeding brought thereon. In case an action or proceeding be brought against the City by reason of any such claim, Contractor, upon notice from the City, shall resist and defend such action claim or proceeding.

Article 8. HOLD HARMLESS AGREEMENT:-The Contractor, its agents and assigns shall indemnify and hold harmless the City of New Britain, including but not limited to, its elected officials, its officers, and agents, ("the City") from any and all claims made against the City, including but not limited to, damages, awards, costs and reasonable attorney's fees, to the extent any such claim directly and proximately results from the wrongful willful or negligent performance of services by the Contractor during the Contractor's performance of this Agreement or any other Agreements of the Contractor entered into by reason thereof. The City agrees to give the Contractor prompt notice of any such claim and absent a conflict of interest, an opportunity to control the defense thereof.

Article 9. Any reference to this Agreement shall be by number. The number assigned to this Agreement shall be #3764.

This Agreement shall be binding on and inure to the benefit of the parties hereto and to their respective successors and assigns.

This Agreement was entered into pursuant to approval of the City of New Britain's Common Council, on _____, Resolution No._____and approved by the Mayor.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the date first above written.

OWNER: CITY OF NEW BRITAIN

BY: _____

WITNESS:

Signed in the presence of: _____

CONTRACTOR:_____

BY: _____

WITNESS:

Signed in the presence of: _____

STATE OF ss:_____ 2014

COUNTY OF

Personally appeared _____ who acknowledged the signing of this to be his free act and deed.

_____
Notary
Commissioner of Superior Court
Justice of the Peace

ACKNOWLEDGMENT OF PRINCIPAL, (IF A CORPORATION)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ___ day of _____, ___, before me, personally came and appeared _____ to me known, who, being by me duly sworn, did depose and say that he is the _____ of _____ the corporation described in and which executed the foregoing instrument; that he knows the seal of said corporation: that one of the impressions affixed to said instrument is an impression of such seal: that it was so affixed by order of the director of said corporation, and that he signed his name thereto by like order.

SEAL

ACKNOWLEDGMENT OF PRINCIPAL, (IF A PARTNERSHIP)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ___ day of _____, ____, before me, personally came and appeared _____ to me known and known to me to be one of the members of the firm of _____ described in and who executed the foregoing instrument and he acknowledged to me that he executed the same as and for the act and deed of said firm.

SEAL

ACKNOWLEDGMENT OF PRINCIPAL, (IF AN INDIVIDUAL)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ___ day of _____, ___, before me, personally came and appeared _____ to me known and known to me to be the person described in and who executed the foregoing instrument and acknowledged that he executed the same.

SEAL

CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned _____ the duly authorized and acting legal representative

of _____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives: that said representatives have full power and authority to execute said agreements on behalf of the respective parties name thereon: and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

BY:_____
Attorney-in-fact

Law Firm: _____

Address – Zip Code:_____

_____

Date: _____

BOND NO.

PERFORMANCE PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we _____

_____ a _____,
(Contractor) (Corporation, Partnership or Individual)

hereinafter called "PRINCIPAL" and _____
(Surety)

of _____, State of _____

hereinafter called the "SURETY", are held and firmly bound unto CITY OF NEW BRITAIN, hereinafter called "OWNER" in the penal sum of

_____ Dollars ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made we bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by these presents.

THE CONDITION OF THIS OF THIS OBLIGATION is such that Whereas the Principal entered into a certain contract with the Owner, dated the day of _____, ____, copy of which is hereto attached and made a part hereof for the construction of the

AW Stanley Park and Aquatic Facilities Improvements, Bid No. 3896

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, and shall promptly make payment to all persons, firms subcontractors, and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

Provided, further, that the said Surety, for value received, hereby stipulates and agrees that no charge, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive

notice of any such change, extensions of time alteration or addition to the terms of the contract or to the work or to the specifications.

PROVIDED FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three (3) counterparts, each one of which shall be deemed an original, this the _____ day of _____, __ ___.

ATTEST:

_____

(Principal) Secretary

BY:

(SEAL)

_____

Witness as to Principal_____

(Address - Zip Code) _____

_____

ATTEST:

_____

Surety

_____ BY: _____

(Surety) Secretary Attorney-in-fact

(SEAL)

_____(Address-Zip Code)

_____

Witness as to Surety

NOTE: Date of Bond must not be prior to date of Contract. If a Partnership, all partners should execute the bond.

_____ _____(Address-Zip Code)

BOND NO.

LABOR AND MATERIAL PAYMENT BOND

Note: This bond is issued simultaneously with another Bond in favor of the Owner conditioned for the full and faithful performance of the Contract.

KNOW ALL MEN BY THESE PRESENTS:

That _____ ,

as Principal (hereinafter called Principal) and

_____ as surety (hereinafter called Surety)

are held and firmly bound unto THE CITY OF NEW BRITAIN as Obligee (hereinafter called Owner) for the use and benefit of claimants as

hereinbelow defined; in the amount of

_____ Dollars ($_____),

for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, principal has written agreement dated

_____, entered into a Contract with Owner for the construction of

AW Stanley Park and Aquatic Facilities Improvements, Bid No. 3896

which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, the condition of this obligation is such that, if the said Principal shall promptly pay for all materials furnished the said Principal shall promptly pay for all materials furnished and labor supplied or performed in the prosecution of the work included in and under the aforesaid Contract, whether or not the material or labor enters into and becomes a component part of the real asset, then this obligation shall be null and void otherwise it shall remain and be in full force and effect.

PROVIDED, that any alterations which may be made in the terms of the Contract or in the work to be done under it, or the giving by the Obligee of any extension of time for the performance of the Contract, or any other forbearance on the part of either the Obligee or the Principal to the other shall not in any way release the Principal and the Surety or either or any of them, their heirs, executors, administrators, successors or assigns from their liability hereunder,

notice to the surety of any such alterations, extension or forbearance being hereby waived.

Any party, whether a subcontractor or otherwise, who furnished materials or supplies or performs labor or services in the prosecution of the work under said Contract, and who is not paid therefor, may bring a suit on this bond in the name of the person suing, prosecute the same to a final judgment, and have execution thereon for such sum as may be justly due.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, ____, the name and corporate seal of each corporation partly being hereto affixed and these presents signed by its undersigned representative, pursuant to authority of its governing body.

In the presence of:

_____ _____ (SEAL)
(Individual Principal)

_____

_____ (SEAL)

_____

Attest: BY:

_____

_____

BY:

Affix Corporate Seal

ATTEST:

_____

_____

BY:
Affix Corporate Seal

Countersigned

by

*Attorney-in-Fact, State of

*Power-of-Attorney for person signing for Surety Company must be attached to Bond.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATION
EXECUTIVE ORDER 11246

1. The offertory's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Females	Minorities
6.9%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Specific Affirmative Action Obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the contract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is

New Britain,	Hartford	Connecticut
(City)	(County)	(State)

ATTACHMENT B

The applicant agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereto, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, the following equal opportunity clause:

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, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. 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 to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers representative of the contractors' commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes to ascertain compliance with such rules, regulations and orders.

(6) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further government construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided

in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for non-compliance: Provided however, that in the event a contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the City to enter into such litigation to protect the interests of the City.

The Contractor is further instructed that any prohibition against discrimination on the basis of age under the Age Discrimination Act of 1975 or with respect to an otherwise qualified handicapped individual as provided in Section 504 of the Rehabilitation Act of 1973 shall also apply to this contract.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in construction work: Provided that if the applicant so participating is a State or local government the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibilities for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government assisted construction contracts pursuant to the Executive order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the executive order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee): refrain from extending any further assistance

to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

ATTACHMENT C

Standard Federal Equal Employment Opportunity Construction Specifications (Executive Order 11246)

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted:

   b. "Director" means director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority.

   c. "Employer identification number" means the Federal Social Security number used on the Employers Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

   d. "Minority" includes:

      1. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      2. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

      3. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands);

      4. American Indian or Alaskan Native; (all persons having origins in any of the original peoples of North America and Maintaining identifiable tribal affiliations through membership and participation or community identification).

      5. Portuguese (all persons of Portuguese, Brazilian or other Portuguese culture or origin regardless of race).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which the contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clauses, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to make good faith efforts to achieve the plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contract should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward the goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

    a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women

to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organization's responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunity and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc. by specific review of the policy with all management personnel and with all minority and female employees at least once a year, and by posting the company EEO policy on bulletin board accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these terms with on site supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the

time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with contractors and Subcontractors with whom the Contractor anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontract from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor union, contractor community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participated in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work-force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's non-compliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the contract may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under utilized.

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, of these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep

records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g. mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g. those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. A geotechnical investigation report for Project and soil-boring data for Project, obtained by GNCB Consulting Engineers, Inc., dated July 28, 2016, is available for viewing **as appended to this Document**.

C. Related Requirements:

1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

END OF DOCUMENT 003132

New Pool and Bathhouse
at Stanley Park
New Britain, Connecticut

Report on
Geotechnical Engineering Investigation

July 28, 2016

Prepared By:
GNCB
Consulting Engineers, P. C.
Old Saybrook, Connecticut

Prepared For:
TLB Architecture, LLC
Chester, Connecticut

GNCB
Consulting Engineers, P.C.

Structural Engineering
Geotechnical Engineering
Historic Preservation
Construction Support

July 28, 2016

Mr. Michael Fortuna
TLB Architecture, LLC
92 West Main Street
Chester, Connecticut 06412

Re: New Pool and Bathhouse at
Stanley Park, New Britain, Connecticut

Dear Michael:

Principals
Kenneth Gibble, P.E.
James F. Norden, P.E.
Charles C. Brown, P.E.

Geotechnical Associate
David L. Freed, P.E.

Structural Associate
Richard A. Centola, P.E.

This report summarizes the results of recent test borings and foundation design studies for the new pool and bathhouse structures at Stanley Park in New Britain, Connecticut. Our work was undertaken in accordance with our contract agreement with you dated March 9, 2011.

In summary, the results of 19 test borings, completed in two phases, indicate that subsurface conditions typically consist of a surface man-placed fill underlain by subsoil, glacial till and rock. We recommend that the new pool base slab consist of a reinforced concrete mat that bears on a minimum 18 in. thickness of ¾ in. size crushed stone that is placed on the natural soils, or on a compacted structural fill. Underslab drains are recommended for the lap pool/deep end areas of the pool. The bathhouse may be supported on normal spread footing foundations with an earth-supported slab on grade.

We appreciate the opportunity to work with you on this aspect of the project. Please call if you have any questions, or need additional information.

Sincerely yours,

David L. Freed, PE
Geotechnical Associate

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P.O. Box 802
Old Saybrook, CT 06475
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GNCB
Consulting Engineers, P.C.

Table of Contents

I. PURPOSE AND SCOPE:

The purpose of this study was to investigate soil, rock and groundwater conditions at the site and to develop foundation design recommendations for renovations to Stanley Park, specifically construction of a new pool and abutting bathhouse, in New Britain, Connecticut. Comments on geotechnical engineering aspects of project construction are also provided.

To achieve these objectives, GNCB Consulting Engineers, P.C. (GNCB) completed the following scope of work:

- Developed and monitored a two phase program of 19 test borings (B-1 to B-11 and B-101 to B-108), one groundwater observation well (at B-7), and four test probes (P-1 to P-4).

- Conducted engineering analyses on soil bearing capacity, settlement, seismic requirements, and other aspects of project design.

- Prepared an engineering report that summarizes the work completed.

II. SITE LOCATION AND SURFACE CONDITIONS:

The new pool and bathhouse is located on the east side of Stanley Street just north of its intersection with Fire House Road in New Britain, Connecticut, as shown on Drawing 1, “Project Locus.” An existing concrete pool and bathhouse, which will be demolished, exists to the north of this new construction. Existing site features, as described below, are shown on a plan

"Topographic/Boundary – Stanley Park" prepared by Martinez Couch & Associates of Rocky Hill, Connecticut, dated March 15, 2016. .
The area of proposed construction is an open grass area that slopes down from southwest to northeast ranging from about El. 200 to El. 180.
(Note: Elevations are in feet and refer to NAVD 1988 Datum). Historic maps of the area show that a stream, that flowed to a pond east of the site, and wetlands area previously passed through the north end of the site; this stream has since been contained within dual below grade RCP pipes.

III. PROPOSED CONSTRUCTION:

A significant portion of the project consists of a new reinforced concrete pool and bathhouse. In addition, new paved parking areas will be construction north and south of the pool, as well new athletic fields and courts. The new pool, which will have a water surface maintained at about El. 190.5, is U shaped with a footprint of about 12,000 sq. ft. Water depths range from a "zero-depth" end, to 5 ft. within the center lap pool, to 11.5 ft. at the diving end. A below grade rectangular-shaped surge tank, having a finish slab grade at El. 179.0, will be constructed adjacent to the deep end of the pool. A concrete deck, at a finish grade about El. 191, surrounds the pool. We also understand that the water within the pool will be drained during periods of non-use (i.e. fall, winter, and spring).

The new one-story bathhouse will be located south of the pool, and will have a finish floor grade at El. 191.00, consistent with the pool deck surface. The building will be masonry construction. Other park improvements consist of new paved parking north and south of the pool/bathhouse complex, and new athletic fields, some of which will exist within the current pool and bathhouse area which will be demolished once the new pool and bathhouse are functional.

The layout of the new pool, bathhouse, and surrounding construction is shown on the attached Drawing 2 “Test Boring Plan.” The existing topography, from the referenced base plan by Martinez Couch & Associates, has been superimposed.

IV. SUBSURFACE INVESTIGATIONS:

We were provided with the locations and logs of 3 test borings drilled for the original pool structure. These borings indicated that subsurface conditions at that location consist of a surface topsoil and underlying sand and gravel; one of the borings required several attempts to bypass boulders.

For foundation design of the current project, GNCB recommended and monitored on a full-time basis a two-phased program that consisted of 19 test borings, one groundwater observation well, and 4 test probes, as follows:

- Phase One: consisting of eleven test borings (B-1 to B-11), a groundwater observation well at B-7, and four probes (P-1 to P-4), drilled during the period February 22 to 23, 2016.
- Phase Two: consisting of eight test borings (B-101- B-108) drilled on July 6, 2016.

The Phase One program provided general information about site soils and rock as needed for initial site planning, while the Phase Two program was completed after the new structures had been located to confirm subsurface conditions in areas missed by the Phase One program. The project surveyor, Martinez Couch & Associates determined by survey the as-drilled locations and ground surface elevations for the Phase One explorations. GNCB located the Phase Two explorations by taping from existing site features and interpolated ground surface elevations based on the base plan contours.

Table I summarizes the subsurface conditions observed at each test boring; detailed soil descriptions are contained in the following report section. Logs of the explorations, prepared by the contractor and reviewed by GNCB, are included as Appendix A.

General Borings, Inc. of Prospect, Connecticut, under contract to GNCB, drilled the explorations using a Case backhoe rig (for Phase One) or a standard truck rig (for Phase Two) to advance 3-1/4 in. inside diameter hollow stem augers (HSAs). At the test borings, soil samples (ASTM D 1586) were obtained generally at 5 ft. intervals; however near continuous sampling was completed within the upper 7 ft. HSAs were advanced for the test probes until refusal was met or the probe was sufficiently deep to confirm rock was not present. The test borings ranged in depth from 5.0 ft. to 18.5 ft, while the probes ranged from 9 to 10 ft. deep. All the test borings terminated in naturally-deposited soils; a number of the test borings (B-1, B-4, B-6, B-7, B-101, B-102, and B-104) terminated at a hard auger refusal on possible bedrock; a core sample was obtained at B-103 to confirm the refusal represents the top of bedrock. Of the four probes, only two (P-2 and P-4) encountered refusal, at depths of 10 and 11 ft., respectively.

A 2 in. diameter PVC groundwater observation well with slotted screen for the lower 10 ft. was installed in the completed test boring B-7 to a well point depth at 19 ft. Table II contains well installation information and observations of groundwater.

V. SUBSURFACE AND GROUNDWATER CONDITIONS:

A. Subsurface Conditions:

The test borings encountered at least three subsurface strata; a man-placed fill underlain by subsoil and glacial till. Geological maps indicated that bedrock below the overburden soils at the site is a red-brown

SANDSTONE; the rock core at B-103 confirmed this rock type. The soil strata encountered in the test borings are described below, progressing downward from ground surface:

Fill: A layer of man-placed fill, ranging in thickness at the test borings from 0.5 ft. to 5.0 ft., blankets the site; however, the fill was as much as 9 ft. thick at B-11. The fill is primarily a granular material consisting of dark brown, brown, or gray silty medium to fine sand, trace to little gravel.
Subsoil: Below the man-placed fill, most of the test borings encountered a deposit of a medium dense brown to light brown fine sandy SILT to SILT that contained from trace to little gravel. As summarized on Table I, the subsoil was typically less than 2 ft. thick.
Alluvium: At B-10, a deposit of alluvium was encountered. This material consisted of a dark brown sandy SILT, with some organic matter. We suspect that the alluvium is associated with former wetland soils.
Glacial Till: All the test borings encountered a deposit of glacial till consisting of a dense to very dense red-brown silty medium to fine SAND, little gravel to fine sandy SILT. The glacial till is a heterogeneous mixture of sand, silt, and gravel that typically directly is underlain by bedrock.
Bedrock: Several of the test borings terminated a few inches into bedrock; at B-103, a 5-ft. core sample of the rock confirms the bedrock type at the site as a red-brown decomposed SANDSTONE. The top of rock at B-103 was at El. 178.5.

B. Groundwater Conditions:

As shown on Table II, groundwater at the observation well B—7/OW is about 17 ft. below ground surface, corresponding to about El. 174 Observations of water level at the completion of test borings are shown on each log and is summarized on Table I; these water levels however were made over a short period of time and may not represent the actual static groundwater level. Regardless, the observation well and test boring

information suggests that groundwater flows downward across the site from southwest to northeast ranging from about El. 180 to El. 170.

In any event, groundwater levels fluctuate with season, construction activity in the area, and other factors. As a result, water levels at the time of construction or after, may differ from those levels shown by the test borings and observation well.

VI. FOUNDATION DESIGN AND CONSTRUCTION:

A. Pool:

We understand that structural design for the pool consists of a reinforced concrete mat, from 8 to 12 in. thick, on which the pool walls rest. We concur with this foundation system. In our opinion, the existing man-placed fill and subsoil are not suitable to support the pool mat foundation. The existing glacial till is a suitable bearing material.

In view of the potential frost susceptible of the natural glacial till and the design criteria that the pool remain empty during the winter sub-freezing temperatures, we recommend that the entire pool mat be constructed on a minimum 18 in. thick layer of ¾ in. size crushed stone placed on a structural filter fabric (such as Mirafi 500X) that is placed between the stone and natural glacial till.

In general, normal excavation to the underside of pool slab plus an additional 18 in. for placement of crushed stone terminates within the natural glacial till. This is demonstrated in the following table which summarizes the bottom of excavation grade and top of natural glacial, in the vicinity of each test boring completed within the pool limits:

Test Boring Locations	Elev of Anticipated Excavation Bott. of Mat	18 in. Below Bott. Mat	Elev. Top of Glacial Till
B-5	186.1	184.6	188.8
B-6/B-6A	184.5	183.0	181.5
B-7/OW	187.8	186.3	189.3
B-101	178.0	176.5	183.8
B-102	184.5	183.0	185.5
B-103	186.0	184.5	189.0

As shown above, except at B-6, we anticipate that normal pool excavation, to an 18 in. depth below the pool for the addition of a frost free material below the pool, will terminate within the suitable glacial till material. At B-6, an additional excavation of about 18 in. will be needed to remove unacceptable bearing material; any such fill below the pool mat/drainage stone should consist of compacted structural fill. During actual excavation, the exposed soil at the excavation bottom will need to be monitored closely to confirm the proper bearing soil exits.

B. Bathhouse:

As for the pool, we recommend that the bathhouse be supported on normal spread footing foundations that bear on the suitable natural glacial till, or on compacted structural fill placed on the suitable soil after removing the surface man-placed fill and subsoil. Based on the 2 test borings drilled for the bathhouse, B-2 and B-104, we anticipate that suitable bearing soil will exist at normal footing bearing grade (about El. 187.5). The ground floor slab may be an earth supported slab-on-grade. We recommend the following design criteria for the bathhouse:

1. Locate bottom of footings at least 3.5 ft. below exterior ground

surface exposed to freezing.

2. Proportion footings for a net allowable soil bearing pressure of 1.7 times the least lateral footing dimension as measured in feet, up to a maximum of 5 kips per sq. ft. (ksf).
3. In the event that compacted structural fill is needed to support footings, carry the foundation preparation and fill to lateral limits extending a distance beyond the edge of the footing equal to the depth of fill below the footing plus two ft.
4. Remove all topsoil, man-placed fill, and other unsuitable material from the building area and to lateral limits for placement of structural fill. Recompact the exposed surface with at least 6 passes of a heavy vibratory roller prior to placing any structural fill. Replace any soft soils with compacted structural fill.

C. Undermat Drains:

At the pool, we recommend perimeter drains at the deep and lap pool areas, in order to minimize the potential for hydrostatic pressures below the pool during periods when the pool is empty. Undermat drains are not required at the shallow “zero-depth” end of the pool, nor are perimeter or underslab drains needed at the bathhouse.

Where recommended, the undermat drains should consist of a series of interconnected 4 in. diameter perforated drains installed within the lower portion of the recommended 18 in. thick layer of crushed stone. The pool walls should be backfilled with a minimum 2 ft. thick zone of compacted structural fill. Details of the recommended foundation drains, including layout and invert grades, are included on the attached Drawing 3,

"Foundation Drain Detail." The lowest drain outlet, at the north end of the pool (i.e. surge tank /deep pool), must be connected to a suitable gravity outlet.

D. Seismic Criteria:

We recommend that the site soil classification is Class C for seismic design. The natural inorganic soil or compacted structural fill to be placed are not susceptible to liquefaction.

E. Lateral Earth Pressures:

The pool exterior walls, and any cantilever site retaining walls, should be designed for soil and surcharge loadings. Hydrostatic pressers are not considered since foundation drainage is recommended. The recommended design values for cantilever walls are:

- retained soil: use an equivalent fluid weight of 35 pcf, plus

- surcharge load: use 0.33 times the vertical load, distributed uniformly over the height of wall.

The following additional criteria apply:

- coefficient of friction: use 0.50 for concrete on the natural silt or compacted structural fill/crushed stone.
- factors of safety: 2.0 for overturning and 1.5 for sliding.

F. Concrete Pool Deck:

A concrete deck surface, at about El. 191.0, surrounds the new main pool construction; refer to Drawing 2 for approximate limits. We also recommend that the pool deck be underlain by a minimum 18 in. thick layer of ¾ in. size crushed stone, in order to minimize potential for winter-time heave of the concrete surface due to freezing of the subgrade. For the most part excavation for the deck surface will terminate in a man-placed fill or on the naturally-deposited subsoil.

Prior to placing any fill below the new pool deck areas, we recommend that the soil subgrade be recompacted with at least 4 passes of a vibratory roller and any soft materials revealed by the recompaction be replaced with compacted common fill.

G. Compacted Structural and Common Fills:

Fill for use as compacted structural fill below the pool mat/crushed stone or bathhouse building, if needed to replace unsuitable bearing soils or raise the grade after excavation, should consist of sandy gravel or gravelly sand, free of organic material, snow, ice or other unsuitable materials, and should be well graded within the following limits:

Sieve Size	Percent Finer By Weight
4 in.	100
¾ in.	45 - 90
No. 4	20 - 80
No. 40	5 - 50
No. 200	0 - 8

Compacted structural fill should be placed in horizontal layers having a maximum loose lift thickness of 9 in. (open areas) or 6 in. (confined areas). Each layer should be compacted to a dry density at least 95 percent of the maximum dry density as determined in accordance with ASTM Test Designation D1557. Based on visual description, we do not believe that any of the excavated soils will be suitable for use as structural fill. Structural fill will need to be obtained from off site.

Compacted common fill placed below the pool deck area (i.e. east portion), as needed to raise the grade to underside of recommended crushed stone, and as needed within paved parking and/or new athletic filed areas, should comply with the requirements for compacted structural fill except as noted below:

- The gradation requirements shall be revised to a maximum 6 in. size and the maximum percent finer by weight passing on the No. 200 sieve shall be 0 to 15 percent.
- Lifts shall not exceed 12 in. in loose lift thickness.
- Each lift shall be compacted to a minimum dry density at least 92 percent of the density determined by ASTM D1557.

Based on visual classifications, we anticipate that the existing man-placed fill (except surface topsoil) will be suitable for use as compacted common fill. In addition, the subsoil may also be suitable. We note however, that both these soils contain significant portions of silt material, which if become wet during the excavation process/placement period, can be difficult to compact if at a water content more than a few percent above optimum. The contractor should attempt to place these soils as soon as they are excavated; and if stockpiling is required the piles should be covered with plastic and graded to shed water, to prevent getting wet during periods of rain.

VII. CONSTRUCTION CONSIDERATIONS:

A. General:

This section provides comments related to foundation construction, earthwork, and other geotechnical aspects of the project. It will aid those responsible for preparation of contract plans and specifications and those involved with construction monitoring. The contractor must evaluate potential construction problems on the basis of their own knowledge and experience in the area and on the basis of similar projects in other localities, taking into account their own proposed construction equipment and procedures.

B. Excavation:

The deepest excavation depth ranges from about 12 ft. within the west end of the zero-depth pool to about 6 ft. within the deep pool area; at other areas excavation depth is typically less than about 5 ft. Material to be removed will consist primarily of the man-placed fill (topsoil, sand and silt), however, some of the natural subsoil and glacial till will be encountered. We expect that normal construction equipment will be adequate for excavation.

Excavation geometry should conform to OSHA excavation regulations contained in 29 CFR Part 1926 dated October 31, 1989. We expect that excavations can be made by open sloped excavation (i.e. without lateral supports). Temporary open slopes should no steeper than 1.5 hor. to 1 ver. should be stable.

C. Dewatering:

We do not anticipate that, excavation to 18 in. below the underside of new pool will extend close to or below groundwater. Surface water runoff which accumulates within excavations must be pumped to maintain dry excavations.

D. Preparation of Bearing Surfaces:

Footing bearing surfaces should be recompacted with a small plate compactor prior to forming/placing steel. Use of a smooth edged bucket, in either fill or natural soil, will minimize the disturbance to the excavated footing surfaces.

E. Construction Monitoring:

The recommendations contained in this report are based on the known and predictable behavior of properly engineered and constructed foundations and other facilities. We recommend that GNCB be retained to partially observe the preparation of the pool mat and bathhouse footing/slab bearing surfaces and backfilling activities. Monitoring of this work is intended to observe compliance with the design concepts and specifications and to allow design changes in the event that subsurface conditions differ from those anticipated prior to construction. GNCB construction administrative services are not intended to comply with the state required special inspection program; we can provide these services, if requested.

VIII. LIMITATIONS OF RECOMMENDATIONS:

This report has been prepared for specific application to the new pool and bathhouse at Stanley Park in New Britain, Connecticut, in accordance with generally accepted geotechnical engineering practice. No other warranty, express of implied, is made. In the event that any changes in the nature, design, or location of the construction is planned, the conclusions and recommendations contained in the report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

The analyses and recommendations in this report are based in part upon data obtained from the referenced test borings and observation well. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

GNCB plans to perform a general review of the final design, contract drawings and specifications in order to confirm that our earthwork and foundation recommendations have been properly interpreted and implemented as they were intended.

GNCB
Consulting Engineers, P.C.

Tables:

I - Summary of Test Borings

II - Summary of Groundwater Levels at B-7/OW

TABLE I

SUMMARY OF TEST BORINGS

NEW POOL AND BATHHOUSE AT STANLEY PARK
NEW BRITAIN, CONNECTICUT

TEST BORING NO.	TOTAL DEPTH (FT.)	APPROX. ELEV. GROUND SURF. (FT)	ELEV. WATER (FT.)	THICKNESS SOIL (FT.)				ELEV. TOP OF (FT.)	
				MAN-PLACED FILL	SUBSOIL	ALLUVIUM	GLACIAL TILL	GLACIAL TILL	ROCK
B-1/B-1A(R)	9.5	181.3	171.8	0.5	-	-	9.0	180.8	171.8
B-2 (R)	13.0	190.3	179.3	1.5	2.0	-	9.5	186.8	Below 177.3
B-3(R)	9.5	186.8	Below 177.3	0.7	1.8	-	7.0	184.3	Below 177.3
B-4(R)	10.0	181.4	Below 171.4	0.5	-	-	9.5	180.9	171.4
B-5(R)	8.0	192.3	Below 184.3	0.5	3.0	-	4.5	188.8	Below 184.3
B-6 (R)	5.5	183.5	Below 178.0	2.0	-	-	3.5	181.5	178.0
B-6A	5.0	182.6	Below 177.6	-	-	-	-	-	177.6
B-7/OW(R)	19.0	191.3	173.9	0.3	1.7	-	17.0	189.3	172.3
B-8	11.0	186.9	179.9	2.5	-	-	8.5+	184.4	Below 175.9
B-9	12.0	190.8	Below 176.8	2.0	-	-	8.0+	188.8	Below 178.8
B-10(R)	14.0	179.6	168.6	5.0	-	6.0	3.0	168.6	165.6
B-11 (R)	11.0	180.5	170.5	9.0	-	-	2.0	171.5	169.5
B-101 (R)	16.5	184.0	-	0.2	0.0	0.0	10.6	183.8	173.2
B-102(R)	11.5	188.0	Below 176.5	0.2	2.3	0.0	7.5	185.5	178.0
B-103(C)	18.5	192.0	-	0.2	2.8	0.0	10.5	189.0	178.5
B-104(R)	15.7	196.0	Below 180.3	0.2	3.3	0.0	8.0	192.5	184.5
B-105	6.0	194.0	Below 188.0	0.2	2.3	0.0	3.5+	191.5	Below 188.0
B-106	6.0	199.0	Below 193.0	0.2	1.8	0.0	4.0+	197.0	Below 193.0
B-107	5.6	191.0	Below 185.14	0.2	1.8	0.0	3.6+	189.0	Below 185.4
B-108	6.0	196.0	below 190.0	0.2	2.3	0.0	3.5+	193.5	Below 190.0

(C) – Cored rock
(R) – Test boring refusal on possible rock.

Notes:

1. **Refer to Drawing 2 for locations of test borings and probes.**
2. **Elevations are in feet and refer to NAVD 1988 Datum.**

GNCB
Consulting Engineers, P.C.

TABLE II

SUMMARY OF GROUNDWATER LEVELS

A.W. STANLEY POOL
NEW BRITAIN, CONNECTICUT

DATE	TIME	ELEVATION OF WATER LEVEL AT B-7/OW (FT.)
February 25, 2016	1100	Installed
February 25, 2016	1200	173.9
March 22, 2016	1700	173.1
July 6, 2016	1300	174.0

NOTES:

1. Refer to Drawing 2 for location of groundwater observation well.

2. Elevations are in feet and refer to NAVD 88 Datum.

3. Installation Details:
   Well material: Scheduled 40 PVC
   Well inside diameter: 2 in.
   Total well length: 19.0 ft., with bottom 10.0 ft. slotted.
   Elevation of ground surface: El. 191.3
   Elevation top of well: El. 191 (0.3 ft. below ground surface).
   Elevation of bottom well: El. 172.0.
   Well backfilled with special filter sand from tip of well to El. 184.0, with bentonite to EL. 186.0, and borehole cuttings to ground surface with flush mount steel protective cap at ground surface.

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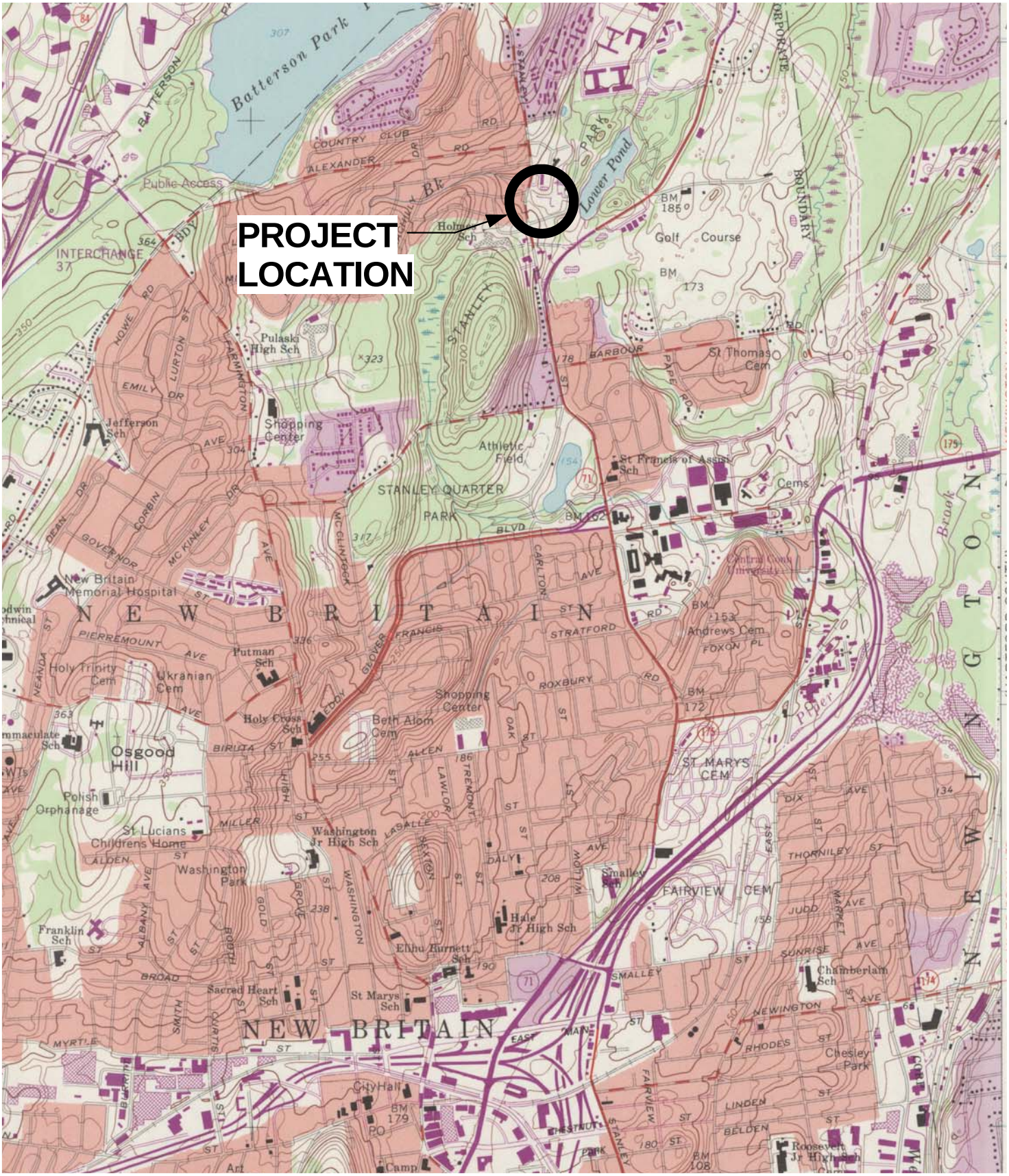
Drawings:

1 – Project Locus

2 - Test Boring Plan – Pool and Bathhouse

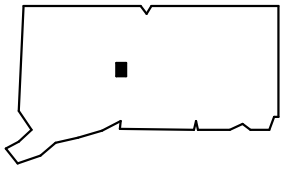
2A – Test Boring Plan – Multi Purpose Field

3 – Foundation Drain Detail



N
W E
S

SITE COORDINATES: 41° 42' 22" N 72° 46' 29" W



U.S.G.S QUADRANGLE: NEW BRITAIN, CT

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STANLEY PARK POOL
STANLEY STREET, NEW BRITIAN, CT

PROJECT LOCUS

1" = 2,000 FT.

JULY 2016

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DRAWING 1

NOTES

1. BASE PLAN IS AN ELECTRONIC COPY OF "TOPOGRAPHIC / BOUNDARY SURVEY" SHEET 2 OF 2, DATED MARCH 15, 2016 BY MARTINEZ COUCH & ASSOCIATES, DRAWING No. 2016-111TP.DWG
2. ELEVATIONS ARE IN FEET AND REFER TO NAVD 88 DATUM.
3. CONTOURS TOP OF GLACIAL TILL AND BEDROCK ARE BASED ON LINEAR INTERPOLATION BETWEEN TEST BORINGS. ACTUAL TOP OF GLACIAL TILL OR BEDROCK MAY VARY FROM THE INDICATED CONTOURS.

LEGEND

B-103	LOCATION OF TEST BORING DRILLED BY GENERAL BORINGS, INC. ON JULY 6, 2016
B-7/OW	LOCATION OF TEST BORING DRILLED BY GENERAL BORINGS, INC. DURING PERIOD FEBRUARY 25-26, 2016; OW INDICATES OBSERVATION WELL
P-1	LOCATION OF PROBE DRILLED BY GENERAL BORINGS ON FEBRUARY 25, 2016
192	EXISTING GROUND SURFACE CONTOURS SHOWN ON BASE PLAN
175	APPROXIMATE CONTOUR ELEVATION TOP OF GLACIAL TILL
175	APPROXIMATE CONTOUR ELEVATION TOP OF ROCK
193	PROPOSED FINISH GRADE OR TOP NEW POOL SLAB

EXISTING DUAL 54" RCP SEWER PIPES
EXISTING PAVED PARKING
NEW PAVED PARKING
NEW PAVED PARKING AREA
NEW DECK AT EL. 191.0
PROPOSED ONE STORY BATH HOUSE FF AT EL. 191.0
DEEP POOL
LAP POOL
ZERO DEPTH POOL
SURGE TANK
EXIST PAVED AREA
NEW COURTS
NEW DECK FF AT EL. 191.0
SLOPES DOWN
SLOPES UP
T.O. WATER 190'-6"
B-1
B-1A
B-2
B-3
B-4
B-6
B-6A
B-8
B-9
B-10
B-11
B101
B102
B103
B104
B105
B106
B7/OW
P-1
P-2
P-3
P-4
B-5
179'-0"
185'-6"
187'-0"
187'-1"
187'-2"
188'-9 1/2"
190'-6"
STANLEY STREET

NORTH

0 50' 100' 150'
GRAPHIC SCALE: 1" = 50'

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STANLEY PARK POOL
STANLEY STREET, NEW BRITIAN, CT
TEST BORING PLAN
SCALE: 1" = 50FT
JULY 2016
DRAWING 2

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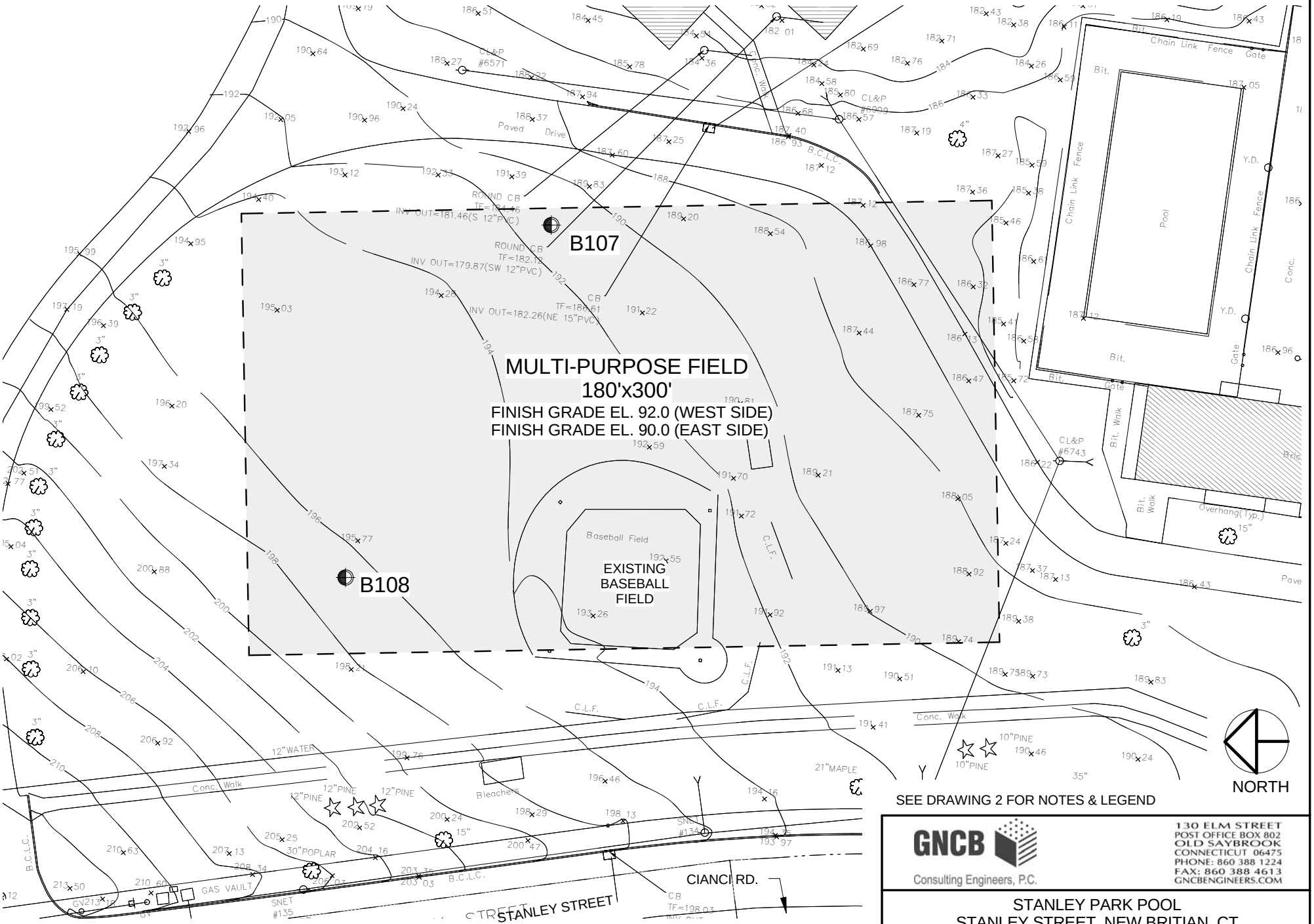

SEE DRAWING 2 FOR NOTES & LEGEND

1 SHEET 2A
1" = 50'-0"

GRAPHIC SCALE: 1" = 50'

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STANLEY PARK POOL
STANLEY STREET, NEW BRITIAN, CT
TEST BORING PLAN - MULTI PURPOSE FIELD

SCALE: 1" = 50'-0"

JULY 2016

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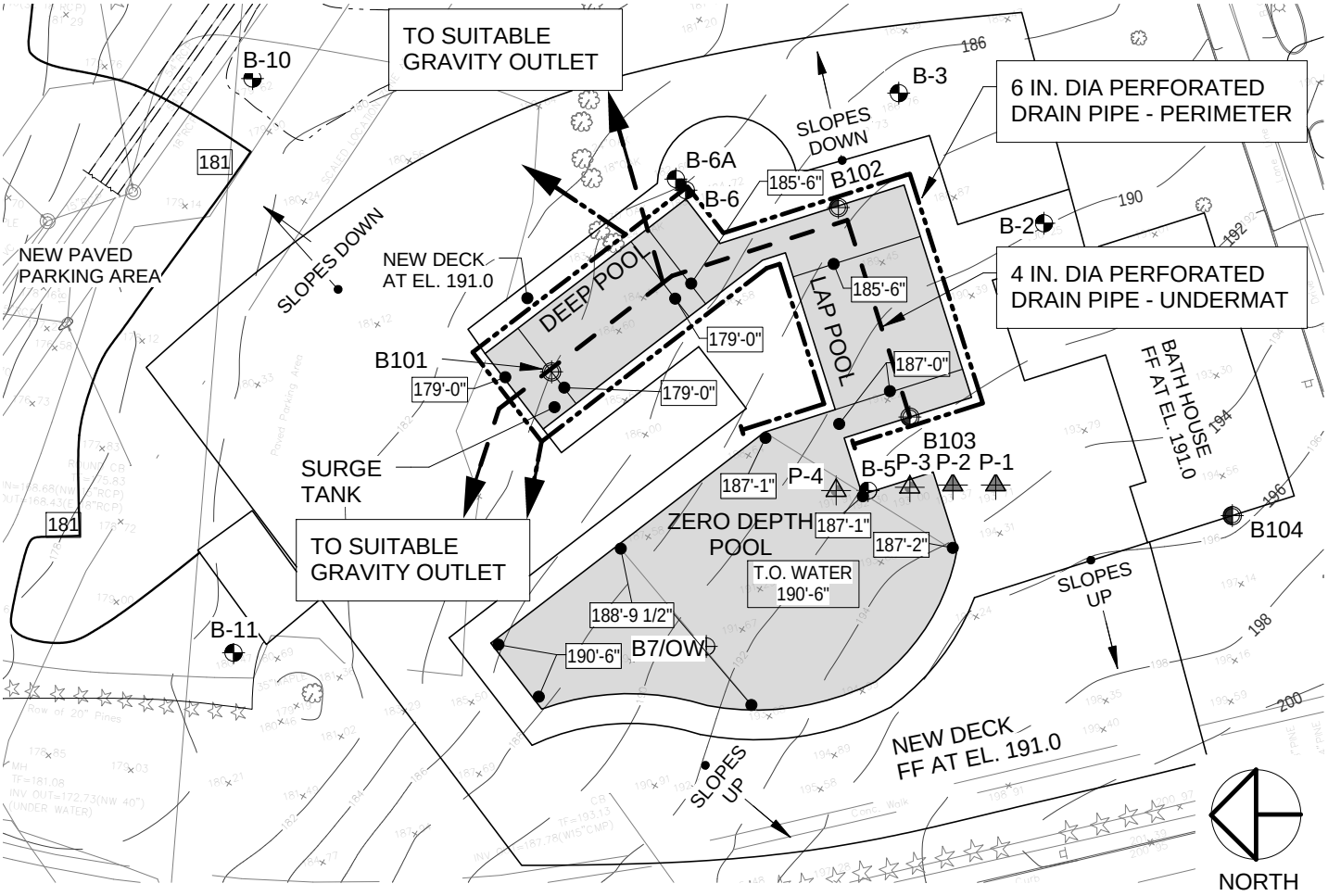
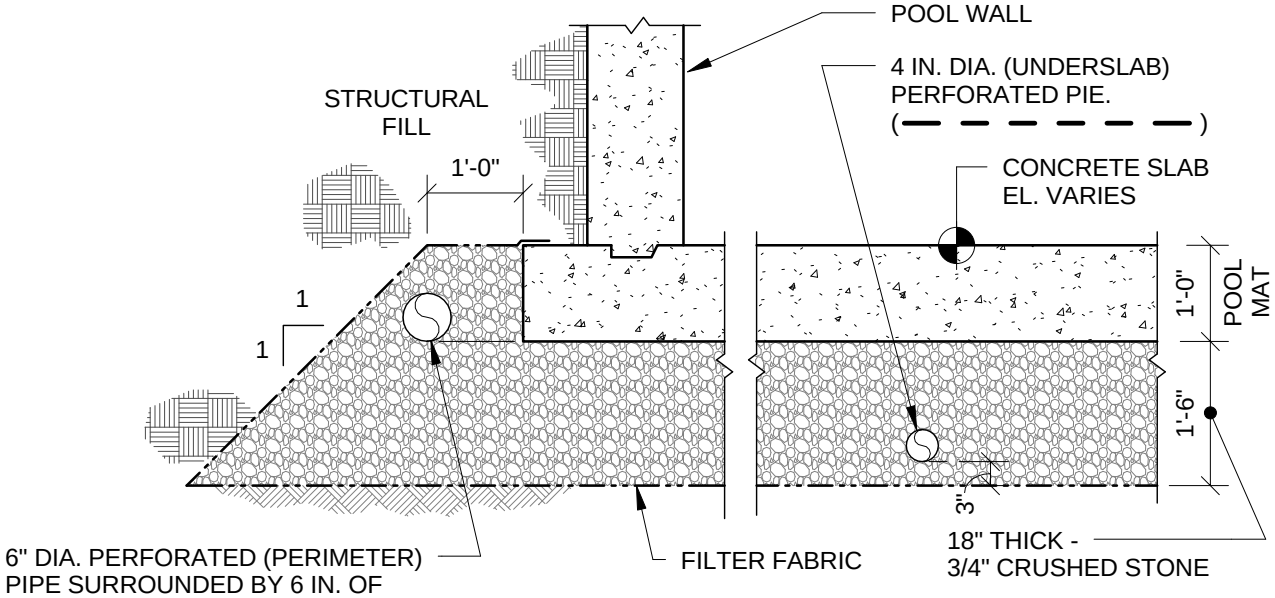


1 FOUNDATION DRAINAGE PLAN
1" = 60'-0"



2 FOUNDATION DRAINAGE SECTION A-A
1/2" = 1'-0"

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STANLEY PARK POOL
STANLEY STREET, NEW BRITIAN, CT

FOUNDATION DRAIN DETAIL

SCALE: As indicated JULY 2016

GNCB
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Appendix A:

Test Boring Logs (B-1 to B-11 and B-101 to B-108)

SHEET 1 OF 1

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

CLIENT: GNCB Consulting Engineers, P.C.

FOREMAN/DRILLER: Robert Poynton

INSPECTOR: Garry Jacobsen

Surface Elevation: 181.3

Date Started: 2/26/16

Date Finished: 2/26/16

Groundwater Observations

AT Dry AFTER 0.0 HRS

AT AFTER HRS

PROJECT NAME: A.W. Stanley Pool Facility

LOCATION: New Britain, CT

GBI JOB NO. 29-16

SOIL ENGINEER

DESIGN ENGINEER

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-1

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	20	SS	3	6	9	11	.5'	1) Medium-Brown silty fine SAND, trace roots, (FILL)
		2.0-4.0	2	24	20	SS	20	17	19	16	TILL 4.5'	1) Red-brown silty coarse-fine SAND, little coarse-fine gravel.
5											EOB	2) Dense-Same as S-1, (TILL) Refusal at 4.5', not smooth, possible boulder.
												END OF BORING 4.5'
10												
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 4.5 Feet in Rock 0 No. of Samples 2 **Hole No.** B-1

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 181.2

GBI JOB NO. 29-16

	TYPE		Casing	Sampler	Core Bar
Date Started: 2/26/16		S Auger				
Date Finished: 2/26/16		H Auger	HA	S . S.	
Groundwater Observations	Size I. D.		3-1/4"	1-3/8"	
AT Dry AFTER 0.0 HRS	Hammer			140 LBS.	Bit
AT AFTER HRS	Fall			30"	

Hole No. B-1A

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
												Moved 5.0' Southeast from B-1
5		5.0-7.0	3	24	7	SS	19	20	24	36	TILL	3) Dense-Red-brown silty coarse-fine SAND, little gravel, possible seams with perched water.
											9.5'	Augered through boulder 7.5'-8.5'
10		9.0-9.2	4	2	2	SS	50/2				EOB	4) Very dense-Red SANDSTONE Chips.
												Augered very hard 9.5'
15												END OF BORING 9.5'
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 9.5 Feet in Rock 0 No. of Samples 4 **Hole No.** B-1A

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

CLIENT: GNCB Consulting Engineers, P.C.

FOREMAN/DRILLER: Robert Poynton

INSPECTOR: Garry Jacobsen

Surface Elevation: 190.3

Date Started: 2/26/16

Date Finished: 2/26/16

Groundwater Observations

AT 11.0 AFTER HRS

AT AFTER HRS

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

LOCATION: New Britain, CT

GBI JOB NO. 29-16

DESIGN ENGINEER

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-2

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	10	SS	2	4	3	2	.5'	1) Stiff-Brown loamy SILT, roots(topsoil)
											1.5' FILL	Red-brown silty coarse-fine SAND,
		2.0-4.0	2	24	10	SS	5	9	8	16	SUBSOIL 3.5	little gravel, (fill)
												2) Stiff-Yellow-brown SILT, trace roots.
5												2) Red-brown coarse-fine sandy SILT,
		5.0-7.0	3	24	16	SS	10	19	24	30		little gravel.
												3) Dense-Red-brown silty coarse-fine
											TILL	SAND, little gravel, few cobbles, moist.
10												
		10.0-11.5	4	18	16	SS	70	28	30			4) Very dense-Red-brown silty coarse-
												fine SAND, little gravel, dry/moist.
											13.0'	Very hard augering several cobbles
											EOB	10.0'-13.0', possible fractured rock,
15												Refusal at 13.0', hard grinding.
												END OF BORING 13.0'
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 13 Feet in Rock 0 No. of Samples 4 **Hole No.** B-2

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 186.8

GBI JOB NO. 29-16

	TYPE	S Auger		Casing	Sampler	Core Bar	**Hole No.** B-3
Date Started: 2/26/16		H Auger		HA	S . S.		Line & Station
Date Finished: 2/26/16	Size I. D.			3-1/4"	1-3/8"		Offset L R
Groundwater Observations	Hammer				140 LBS.	Bit	N Coordinate
AT Dry AFTER 0.0 HRS	Fall				30"		E. Coordinate
AT AFTER HRS							

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	12	SS	3	4	4	5	.7'	Dark brown loamy SILT (TOPSOIL)
											2.5'	1) Stiff-Yellow-brown SILT, little coarse-fine gravel. (SUBSOIL)
		2.0-4.0	2	24	18	SS	8	11	8	10		
5												2) Medium-Red-brown silty coarse-fine gravel.
		5.0-6.2	3	15	12	SS	13	17	50/3		TILL	3) Very dense-Same as S-2, with red sandstone chips in tip of spoon.
												Augered very hard 8.0'-9.5'
											9.5'	Auger refused at 9.5'
10											EOB	END OF BORING 9.5'
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 95 Feet in Rock 0 No. of Samples 3 **Hole No.** B-3

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 181.4

GBI JOB NO. 29-16

Date Started: 2/25/16	TYPE	S Auger		Casing	Sampler	Core Bar
Date Finished: 2/25/16		H Auger		HA	S . S.	
Groundwater Observations	Size I. D.			3-1/4"	1-3/8"	
AT Dry AFTER 0.0 HRS	Hammer				140 LBS.	Bit
AT AFTER HRS	Fall				30"	

Hole No. B-4

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	12	SS	3	5	8	10	.5'	Brown fine sandy SILT, trace roots, fill.
		2.0-4.0	2	24	14	SS	11	17	10	11		1) Dense-Mottled brown to red brown silty SAND, little gravel.
5											TILL	2) Medium-Same as S-1, moist.
		5.0-7.0	3	24	18	SS	10	15	16	18		3) Medium-Same as S-1, with numerous sandstone chips in bottom of samples, some seams appear wet.
10											10.0'	Augered very hard, steady 9.0'-10.0'
											EOB	Refusal at 10.0'
												END OF BORING 10.0'
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 10 Feet in Rock 0 No. of Samples 3 **Hole No.** B-4

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

CLIENT: GNCB Consulting Engineers, P.C.

FOREMAN/DRILLER: Robert Poynton

INSPECTOR: Garry Jacobsen

Surface Elevation: 192.3

Date Started: 2/25/16

Date Finished: 2/25/16

Groundwater Observations

AT Dry AFTER 0.0 HRS

AT AFTER HRS

PROJECT NAME: A.W. Stanley Pool Facility

LOCATION: New Britain, CT

GBI JOB NO. 29-16

SOIL ENGINEER

DESIGN ENGINEER

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-5

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	10	SS	3	3	2	1	.5'	1) Soft-Brown loamy SILT, little roots.
											SUBSOIL	
		2.0-4.0	2	24	20	SS	5	9	8	15	3.5'	2) Hard-Mottled brown to tan SILT, little coarse-fine gravel.
5												Bottom Red-brown silty coarse-fine SAND.
		5.0-7.0	3	24	18	SS	13	25	22	17	TILL	
											8.0'	3) Hard-Red-brown coarse-fine sandy SILT, little coarse-fine gravel.
											EOB	Augered very hard and steady 7.0'-8.0'
10												Refusal at 8.0'
												END OF BORING 8.0'
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 8 Feet in Rock 0 No. of Samples 3 **Hole No.** B-5

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.
P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 183.5

GBI JOB NO. 29-16

Date Started: 2/25/16

Date Finished: 2/25/16

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-6

Line & Station

Offset L R

N Coordinate

E. Coordinate

Groundwater Observations

AT Dry AFTER 0.0 HRS

AT AFTER HRS

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	16	SS	3	7	12	9	SUBSOIL	1) Hard-Mottled brown coarse-fine SILT, trace gravel, trace roots,
		2.0-4.0	2	24	18	SS	15	16	17	15	TILL	(disturbed subsoil)
5											5.5'	Red-brown silty coarse-fine SAND, little coarse-fine gravel.
											EOB	Aguered very hard to steady 5.0'-5.5' Refusal
												END OF BORING 5.5'
10												
15												
												B-6A Moved 7.0' Northeast
												Augered hard 3.0'-4.5'
												Very hard 4.5'-5.0'
20												Refusal at 5.0', dry.
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 5.5 Feet in Rock 0 No. of Samples 2 **Hole No.** B-6

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 191.3

GBI JOB NO. 29-16

	TYPE	S Auger		Casing	Sampler	Core Bar	Hole No. B-7/OW
Date Started: 2/25/16		H Auger		HA	S . S.		Line & Station
Date Finished: 2/25/16	Size I. D.			3-1/4"	1-3/8"		Offset L R
Groundwater Observations	Hammer				140 LBS.	Bit	N Coordinate
AT 17.4 AFTER 1.0 HRS	Fall				30"		E. Coordinate
AT AFTER HRS							

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	14	SS	2	3	4	3	.3'	1) Soft-Brown sandy SILT, trace roots.
											2.0' SUBSOIL	1) Very stiff-Light brown fine-medium
		2.0-4.0	2	24	16	SS	8	9	9	5		sandy SILT, little fine gravel.
											TILL	2) Medium-Red-brown silty coarse-fine
5											5.5'	SAND, little gravel.
		5.0+-7.0	3	24	18	SS	12	8	8	8		3) Stiff-Brown SILT, little fine sand, trace
											SILT	fine gravel.
10											10.0'	Augered easily to 10.0'
		10.0-11.5	4	18	0	SS	35	42	45			4) No recovery, pushed gravel?
												Augered hard 10.0'-15.0'
											TILL	
15												
		15.0-16.0	5	12	12	SS	44	65				5) Hard-Red-brown coarse-fine sandy
												SILT, little gravel, dry
												Auger harder at 16.5'
											19.0'	Suddenly started grinding at 19.0'
20											EOB	refusal.
												END OF BORING 19.0'
												Installed 2" PVC Well at 19.0'
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 19 Feet in Rock 0 No. of Samples 5 **Hole No.** B-7/OW

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

CLIENT: GNCB Consulting Engineers, P.C.

FOREMAN/DRILLER: Robert Poynton

INSPECTOR: Garry Jacobsen

Surface Elevation: 186.9

Date Started: 2/26/16

Date Finished: 2/26/16

Groundwater Observations

AT 7.0 AFTER 0.0 HRS

AT AFTER HRS

PROJECT NAME: A.W. Stanley Pool Facility

LOCATION: New Britain, CT

GBI JOB NO. 29-16

SOIL ENGINEER

DESIGN ENGINEER

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-8

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	14	SS	2	3	8	7	FILL 2.5'	1) Medium-Red-brown silty coarse-fine SAND, little gravel.
		2.0.-4.0	2	24	8	SS	8	19	21	18		2) Dense-Same as S-1 Poor recovery ? To gravel fragments
5											TILL	but similar to above.
		5.0-7.0	3	24	20	SS	21	18	20	19		3) Dense-Red-brown silty coarse-fine SAND, little gravel, moist.
		7.0-8.5	4	18	8	SS	19	28	40			4) Very dense-Same as S-3, except wet. (probable trapped water 3.0' drop)
10												
		10.0-11.0	5	12	0	SS	43	59			11.0'	5) No recovery, augered hard 5.0'-10.0'
											EOB	END OF BORING 11.0'
15												
												Note: Hole caved at 5.0' after withdrawing augers, due to perched water.
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 11 Feet in Rock 0 No. of Samples 5 **Hole No.** B-8

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 190.8

GBI JOB NO. 29-16

	TYPE	S Auger		Casing	Sampler	Core Bar
Date Started: 2/26/16		H Auger		HA	S . S.	
Date Finished: 2/26/16	Size I. D.			3-1/4"	1-3/8"	
Groundwater Observations	Hammer				140 LBS.	Bit
AT Dry AFTER 0.0 HRS	Fall				30"	
AT AFTER HRS						

Hole No. B-9

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	12	SS	3	4	13	15	FILL 2.0'	No topsoil 1) Medium-Red-brown coarse-fine sandy SILT, little coarse-fine gravel, with gray cobble fragments.
		2.0-4.0	2	24	18	SS	8	6	5	8		
5												
		5.0-6.7	3	20	18	SS	7	9	25	20/2	TILL	2) Stiff-Red-brown coarse-fine sandy SILT, trace coarse-fine gravel, (moist) 3) Dense-Same as S-2, except dry.
10												
		10.0-12.0	4	24	18	SS	15	19	19	22	12.0' EOB	4) Dense-Red-brown to light brown coarse-fine sandy SILT, little coarse-fine gravel, with seams of silty fine sand.
15												END OF BORING 12.0'
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 12 Feet in Rock 0 No. of Samples 4 **Hole No.** B-9

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 179.6

GBI JOB NO. 29-16

	TYPE	S Auger		Casing	Sampler	Core Bar	**Hole No.** B-10
Date Started: 2/25/16		H Auger		HA	S . S.		Line & Station
Date Finished: 2/25/16	Size I. D.			3-1/4"	1-3/8"		Offset L R
Groundwater Observations	Hammer				140 LBS.	Bit	N Coordinate
AT 11.0 AFTER 0.0 HRS	Fall				30"		E. Coordinate
AT AFTER HRS							

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
											.2'	2" Asphalt Pavement
		1.0-3.0	1	24	10	SS	11	6	6	5		1) Medium-Intermixed gray to red-
											FILL	brown gravelly coarse-fine SAND, some
		3.0-50	2	24	12	SS	9	13	7	7		silt.
5											5.0'	2) Medium-Same as above
		5.0-7.0	3	24	12	SS	11	5	8	4		3) Medium-Intermixed dark brown
												to red-brown coarse sandy SILT, little
		7.0-9.0	4	24	18	SS	7	5	5	4		coarse-fine gravel.
											ALLUVIUM	4) Medium-Same as S-3, with pockets
10		9.0-11.0	5	24	20	SS	2	3	6	3		of organic silt, trace roots.
											11.0'	5) Medium-Brown organic SILT,
		11.0-12.3	6	24	18	SS	7	25	24	30/3"	TILL	trace roots with pockets of sandy
												SILT little gravel
											14.0'	6 Hard-Red-brown coarse-fine
15											EOB	sandy SILT, little gravel.
												Hollow auger refused at 14.0'
												Augered very hard and steady
												13.5'-14.0'
												END OF BORING 14.0'
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 14 Feet in Rock 0 No. of Samples 6 **Hole No.** B-10

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
Robert Poynton

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 180.5

GBI JOB NO. 29-16

Date Started: 2/25/16

Date Finished: 2/25/16

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-11

Line & Station

Offset L R

N Coordinate

E. Coordinate

Groundwater Observations

AT 10.0 AFTER 0.0 HRS

AT AFTER HRS

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		1.0-3.0	1	24	12	SS	12	13	11	14		1) Medium-Red-brown silty coarse-fine SAND, little coarse-fine gravel.
		3.0-5.0	2	24	18	SS	17	18	29	24		2) Dense-Same as S-1
5											FILL	
		5.0-7.0	3	24	14	SS	10	12	12	29		3) Medium-Intermixed gray to red-brown coarse-fine SAND, little silt and gravel.
											9.0'	Augered through/past boulders 7.5'-9.0'
10		9.0-11.0	4	24	18	SS	18	31	21	31	10.0'	or possible fractured rock.
											EOB	4) Very dense-Brown variable silty coarse-fine SAND little gravel to coarse-fine gravel. (TILL) Unable to auger past 10.0' probable fractured rock.
15												END OF BORING 10.0'
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 10 Feet in Rock 0 No. of Samples 4 **Hole No.** B-11

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT: GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER: John Wyant

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 184 (est.)

GBI JOB NO. 29-16A

	TYPE		Casing	Sampler	Core Bar	
Date Started: 7/6/16		S Auger				**Hole No.** B-101
Date Finished: 7/6/16		H Auger	HA	S . S.	NQ	Line & Station
Groundwater Observations	Size I. D.		3-1/4"	1-3/8"	2-1/8"	Offset L R
AT None AFTER 0.0 HRS	Hammer			140 LBS.	Bit	N Coordinate
AT AFTER HRS	Fall			30"	Diamond	E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	16	SS	6	19	31	40	.2"	2" Topsoil
											1.0'	1) Top 5" Very dense-Light brown
		2.0-4.0	2	24	16	SS	41	33	34	22		SILT, trace fine sand (subsoil)
											TILL	1) Bottom 11" Very dense-Red-brown
5												fine-medium SAND, some silt, little
		5.0-7.0	3	24	12	SS	24	50	34	23		fine-medium gravel.
												2) Very dense-Red-brown fine-medium
												SAND and SILT, some fine-medium
												gravel (till)
10		8.0-10.0	1	24	12	C					10.8'	3) Very dense-Same as S-2, possible
		10.00-10.7	4	8	8	SS	54	50/2				rock in tip.
											DEOMPOSED	1) Cored Boulder 8.0'-10.0'
											ROCK	4) Very dense-Weathered ROCK
												(sandstone)
15												
		15.0-15.3	5	3	3	SS	60/3				16.5'	5) Very dense-Fractured ROCK.
											EOB	Auger refused at 16.5'
												END OF BORING 16.5'
20												
25												
												Note: Insufficient time for proper water
												level reading
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 16.5 Feet in Rock 0 No. of Samples 5 **Hole No.** B-101

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
John Wyant

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 188 (est.)

GBI JOB NO. 29-16A

Date Started: 7/6/16	TYPE	S Auger	Casing	Sampler	Core Bar
Date Finished: 7/6/16		H Auger	HA	S . S.	
Groundwater Observations	Size I. D.		3-1/4"	1-3/8"	
AT None AFTER 0.0 HRS	Hammer			140 LBS.	Bit
AT AFTER HRS	Fall			30"	

Hole No. B-102

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	12	SS	5	11	13	15	.2'	2" Topsoil
											2.5'	1) Medium-Light brown fine SAND, some silt. (SUBSOIL)
		2.0-4.0	2	24	16	SS	12	18	26	24		
5											TILL	2) Dense-Red-brown fine-medium SAND and SILT, little fine-medium gravel
		5.0-7.0	3	24	10	SS	7	30	45	50		3) Very dense-Same as S-2, different color.
10											10.0'	
		10.00-10.8	4	9	9	SS	36	50/3			11.5'	4) Very dense-Fractured ROCK.
											EOB	Auger refused at 11.5'
												END OF BORING 11.5'
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 11.5 Feet in Rock 0 No. of Samples 4 **Hole No.** B-102

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

CLIENT: GNCB Consulting Engineers, P.C.

FOREMAN/DRILLER: John Wyant

INSPECTOR: Garry Jacobsen

Surface Elevation: 192 (est.)

Date Started: 7/6/16

Date Finished: 7/6/16

Groundwater Observations

AT AFTER HRS

AT AFTER HRS

PROJECT NAME: A.W. Stanley Pool Facility

LOCATION: New Britain, CT

GBI JOB NO. 29-16A

SOIL ENGINEER

DESIGN ENGINEER

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	NQ
Size I. D.			3-1/4"	1-3/8"	2-1/8"
Hammer				140 LBS.	Bit
Fall				30"	Diamond

Hole No. B-103

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	16	SS	9	10	8	8	.2'	2" Topsoil
											SUBSOIL	1) Medium-Light brown fine SAND,
		2.0-4.0	2	24	18	SS	16	18	20	18	3.0'	some silt.
												2) Dense-Red-brown fine SAND and
5												SILT, some fine-medium gravel.
		5.0-7.0	3	24	18	SS	17	35	41	40	TILL	3) Very dense-Red-brown fine-medium
												SAND, some silt, some fine-medium
												gravel.
10												
		10.0-11.3	4	15	14	SS	7	20	50/3			4) Hard-Red-brown SILT, some fine
												sand, trace clay, sandstone (rock) in
											13.5'	tip.
										2		
15										2		Run#1-Cored decomposed SANDSTONE
										2	ROCK	13.5'-18.5'
										2		Recovered 57" (97 percent)
		13.5-18.5	1	60	57	C				2	18.5'	RQD=19" (32 percent)
											EOB	END OF BORING 18.5'
20												
25												Note: Drill water used to core rock, prevented a water level reading.
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 13.5 Feet in Rock 5 No. of Samples 4 **Hole No.** B-103

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
John Wyant

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 196 (est.)

GBI JOB NO. 29-16A

Date Started: 7/6/16	TYPE	S Auger		Casing	Sampler	Core Bar
Date Finished: 7/6/16		H Auger		HA	S . S.	
Groundwater Observations	Size I. D.			3-1/4"	1-3/8"	
AT None AFTER 0.0 HRS	Hammer				140 LBS.	Bit
AT AFTER HRS	Fall				30"	

Hole No. B-104

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	14	SS	3	11	23	21	.2'	2" Topsoil
											SUBSOIL	1) Medium-Light brown fine SAND, some
		2.0-4.0	2	24	18	SS	16	14	14	25	3.5'	silt.
												2) Medium-Brown fine-medium SAND
5												and SILT, same fine-medium gravel.
		5.0-7.0	3	24	0	SS	16	24	16	15		3) No recovery
											TILL	
10												
		10.0-11.9	4	23	20	SS	31	35	50	50/5	11.5'	4) Very dense-Red-brown fine-medium
												SAND, some silt, some fine-medium
											ROCK	gravel.
15											15.7'	
		15.0-15.7	5	8	8	SS	16	50/2			EOB	5) Very dense-Decomposed SANDSTONE
												END OF BORING 15.7'
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 15.7 Feet in Rock 0 No. of Samples 5 **Hole No.** B-104

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

CLIENT: GNCB Consulting Engineers, P.C.

FOREMAN/DRILLER: John Wyant

INSPECTOR: Garry Jacobsen

Surface Elevation: 194 (est.)

Date Started: 7/6/16

Date Finished: 7/6/16

Groundwater Observations

AT None AFTER 0.0 HRS

AT AFTER HRS

PROJECT NAME: A.W. Stanley Pool Facility

LOCATION: New Britain, CT

GBI JOB NO. 29-16A

SOIL ENGINEER

DESIGN ENGINEER

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-105

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	14	SS	8	16	12	12	.2'	2" Topsoil
											SUBSOIL	1) Medium-Light brown fine SAND, some
		2.0-4.0	2	24	16	SS	15	31	46	36	2.5'	silt.
												2) Very dense-Red-brown fine-medium
5		4.0-6.0	3	24	14	SS	38	46	40	35	TILL	SAND and SILT, some fine-medium
											6.0'	gravel.
											EOB	3) Very dense-Same as S-2
												END OF BORING 6.0'
10												
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 6 Feet in Rock 0 No. of Samples 3 **Hole No.** B-105

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.
P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
John Wyant

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 199 est,)

GBI JOB NO. 29-16A

	TYPE		Casing	Sampler	Core Bar
Date Started: 7/6/16	S Auger		HA	S . S.	
Date Finished: 7/6/16	H Auger				
Groundwater Observations	Size I. D.		3-1/4"	1-3/8"	
AT None AFTER 0.0 HRS	Hammer			140 LBS.	Bit
AT AFTER HRS	Fall			30"	

Hole No. B-106
Line & Station
Offset L R
N Coordinate
E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	4	SS	5	12	13	10	.2'	2" Topsoil
											2.0'	1) Medium-Light brown fine SAND, some silt. (SUBSOIL)
		2.0-4.0	2	4	14	SS	11	19	25	25		
											TILL	2) Dense-Red-brown fine-medium SAND some silt, little fine-medium gravel.
5		4.0-6.0	3	24	16	SS	14	19	30	36	6.0'	
											EOB	3) Dense-Red-brown fine-medium SAND and SILT, some fine-medium gravel, trace silt, (till.
												END OF BORING 6.0'
10												
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 6 Feet in Rock 0 No. of Samples 3 **Hole No.** B-106

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

CLIENT:
GNCB Consulting Engineers, P.C.

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

FOREMAN/DRILLER:
John Wyant

SOIL ENGINEER

PROJECT NAME: A.W. Stanley Pool Facility

INSPECTOR: Garry Jacobsen

LOCATION: New Britain, CT

DESIGN ENGINEER

Surface Elevation: 191 (est.)

GBI JOB NO. 29-16A

Date Started: 7/6/16	TYPE	S Auger	Casing	Sampler	Core Bar
Date Finished: 7/6/16		H Auger	HA	S . S.	
Groundwater Observations	Size I. D.		3-1/4"	1-3/8"	
AT None AFTER 0.0 HRS	Hammer			140 LBS.	Bit
AT AFTER HRS	Fall			30"	

Hole No. B-107

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	12	SS	7	20	20	35	.2'	2" Topsoil
											2.0'	1) Hard-Light brown SILT and fine
		2.0-4.0	2	24	18	SS	15	18	16	20		SAND, trace roots. (SUBSOIL)
											TILL	2) Dense-Brown silty fine SAND, little
5											5.6'	fine-medium gravel.
		5.0-5.6	3	7	7	SS	35	100/4			EOB	3) Hard-Red-brown SILT, some fine-
												medium sand and gravel.
												Refusal on boulder
												END OF BORING 5.6'
10												
15												
20												
25												
30												
35												
40												

Groundwater Observations: AT None AFTER 0.0 HRS; AT AFTER HRS

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 5.6 Feet in Rock 0 No. of Samples 3 **Hole No.** B-107

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SHEET 1 OF 1

General Borings, Inc.

P. O. BOX 7135 PROSPECT, CT 06712

CLIENT: GNCB Consulting Engineers, P.C.

FOREMAN/DRILLER: John Wyant

INSPECTOR: Garry Jacobsen

Surface Elevation: 196 (est.)

Date Started: 7/6/16

Date Finished: 7/6/16

Groundwater Observations

AT None AFTER 0.0 HRS

AT AFTER HRS

PROJECT NAME: A.W. Stanley Pool Facility

LOCATION: New Britain, CT

GBI JOB NO. 29-16A

SOIL ENGINEER

DESIGN ENGINEER

TYPE	S Auger		Casing	Sampler	Core Bar
	H Auger		HA	S . S.	
Size I. D.			3-1/4"	1-3/8"	
Hammer				140 LBS.	Bit
Fall				30"	

Hole No. B-108

Line & Station

Offset L R

N Coordinate

E. Coordinate

DEPTH	Casing blows per foot	SAMPLE DEPTH IN FEET FROM - TO	NO.	PEN. IN	REC. IN	TYPE	BLOWS PER 6 INCHES ON SAMPLER 0-6	6-12	12 18	18 24	STRATA CHANGE: DEPTH, ELEV.	FIELD IDENTIFICATION OF SOIL, REMARKS (INCL. COLOR, LOSS OF WASH WATER, ETC.)
		0-2.0	1	24	18	SS	2	6	7	8	.2'	2" Topsoil
											2.5'	1) Medium-Light brown fine SAND, some
		2.0-4.0	2	24	20	SS	5	12	8	13		silt. (SUBSOIL)
											TILL	2) Medium-Red-brown fine-medium
5		4.0-6.0	3	24	20	SS	23	56	65	35		SAND and SILT, some fine-medium
											6.0'	gravel.
											EOB	3) Very dense-Light brown fine-medium
												SAND, some silt, trace fine-medium
												gravel.
10												END OF BORING 6.0'
15												
20												
25												
30												
35												
40												

From Ground Surface to Feet Used in. Casing Then in. Casing For Feet

Feet in Earth 6 Feet in Rock 0 No. of Samples 3 **Hole No.** B-108

SAMPLE TYPE CODING: SS = DRIVEN C = CORE A = AUGER U = UNDISTURBED PISTON

PROPORTIONS USED: TRACE = 1-10% LITTLE = 10-20% SOME = 20-35% AND = 35-50%

SECTION 009040 - CONTRACT LABOR RATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and Division 1, Apply to work specified in this Section.

1.02 PREVAILING WAGE RATES

A. The Contractor shall fully comply with all provisions of Connecticut General Statutes (CGS) 31-53 and shall be subject to such sanctions mandated for violations of said Public Act.

B. The contractor shall not be paid in accordance with the payment provisions of these Contract Bidding Documents unless the contractor is in full compliance with the mandates of CGS 31-53.

1.03 ADDITIONAL INFORMATION

A. Contractor is responsible for visiting the State of CT, Department of Labor Website at the following address to obtain the necessary documents to include in your Bid.

1. http://www.ctdol.state.ct.us/wgwkstnd/BidPack.htm

B. **PREVAILING WAGE BID PACKAGE INCLUDES THE FOLLOWING:**

- Prevailing Wage Law Poster (PDF, 97KB)
- Section 31-53b: Construction safety and Health Course. Proof of completion required for employees on public building projects. (PDF, 10KB)
  - Informational Bulletin - The 10-Hour OSHA Construction Safety and Health Course(PDF, 20KB)
- Notice For All Mason Contractors (PDF, 5KB)
- CT General Statute 31-55a
- Contracting Agency Certification Form (PDF, 89KB)
- Contractor's Wage Certification Form (PDF, 11KB)
- Payroll Certification - Public Works Projects
- Occupational Classification Bulletin
- Footnotes (Rev. 06/15) (PDF, 24KB)

Minimum Rates and Classifications for Building Construction

ID# : B 22547

Connecticut Department of Labor
Wage and Workplace Standards Division

By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages.

Project Number:

Project Town: New Britain

State#:

FAP#:

Project: AW Stanley Park And Aquatic Facilities Improvements

CLASSIFICATION	Hourly Rate	Benefits
1a) Asbestos Worker/Insulator (Includes application of insulating materials, protective coverings, coatings, & finishes to all types of mechanical systems; application of firestopping material for wall openings & penetrations in walls, floors, ceilings	35.75	28.82
1b) Asbestos/Toxic Waste Removal Laborers: Asbestos removal and encapsulation (except its removal from mechanical systems which are not to be scrapped), toxic waste removers, blasters.**See Laborers Group 7**		
1c) Asbestos Worker/Heat and Frost Insulator	37.15	27.56

As of: **Friday, August 12, 2016**

2) Boilermaker	35.24	25.01
3a) Bricklayer, Cement Mason, Concrete Finisher (including caulking), Stone Masons	33.48	29.16 + a
3b) Tile Setter	34.30	24.15
3c) Terrazzo Mechanics and Marble Setters	31.69	22.35
3d) Tile, Marble & Terrazzo Finishers	26.43	20.59
3e) Plasterer	33.48	29.16

As of: **Friday, August 12, 2016**

Project: AW Stanley Park And Aquatic Facilities Improvements

------LABORERS------

4) Group 1: Laborers (common or general), acetylene burners, carpenter tenders, concrete specialists, wrecking laborers, fire watchers.	28.55	18.90
4a) Group 2: Mortar mixers, plaster tender, power buggy operators, powdermen, fireproofer/mixer/nozzleman (Person running mixer and spraying fireproof only).	28.80	18.90
4b) Group 3: Jackhammer operators/pavement breaker, mason tender (brick), mason tender (cement/concrete), forklift operators and forklift operators (masonry).	29.05	18.90
4c) **Group 4: Pipelayers (Installation of water, storm drainage or sewage lines outside of the building line with P6, P7 license) (the pipelayer rate shall apply only to one or two employees of the total crew who primary task is to actually perform the mating of pipe sections) P6 and P7 rate is $26.80.	28.80	18.90
4d) Group 5: Air track operator, sand blaster and hydraulic drills.	29.30	18.90

4e) Group 6: Blasters, nuclear and toxic waste removal.	31.55	18.90
4f) Group 7: Asbestos/lead removal and encapsulation (except it's removal from mechanical systems which are not to be scrapped).	29.55	18.90
4g) Group 8: Bottom men on open air caisson, cylindrical work and boring crew.	28.38	18.90
4h) Group 9: Top men on open air caisson, cylindrical work and boring crew.	27.86	18.90
4i) Group 10: Traffic Control Signalman	16.00	18.90
5) Carpenter, Acoustical Ceiling Installation, Soft Floor/Carpet Laying, Metal Stud Installation, Form Work and Scaffold Building, Drywall Hanging, Modular-Furniture Systems Installers, Lathers, Piledrivers, Resilient Floor Layers.	32.00	24.42

As of: **Friday, August 12, 2016**

5a) Millwrights	32.47	24.84
6) Electrical Worker (including low voltage wiring) (Trade License required: E1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9)	37.50	25.06+3% of gross wage
7a) Elevator Mechanic (Trade License required: R-1,2,5,6)	49.00	29.985+a+b
-----LINE CONSTRUCTION----		
Groundman	24.99	6.25%+11.81
Linemen/Cable Splicer	45.43	6.25%+20.70

As of: **Friday, August 12, 2016**

8) Glazier (Trade License required: FG-1,2)	35.58	20.15 + a
9) Ironworker, Ornamental, Reinforcing, Structural, and Precast Concrete Erection	35.22	31.99 + a
----OPERATORS----		
Group 1: Crane handling or erecting structural steel or stone, hoisting engineer 2 drums or over, front end loader (7 cubic yards or over), work boat 26 ft. and over and Tunnel Boring Machines. (Trade License Required)	38.55	23.55 + a
Group 2: Cranes (100 ton rate capacity and over); Excavator over 2 cubic yards; Piledriver ($3.00 premium when operator controls hammer); Bauer Drill/Caisson. (Trade License Required)	38.23	23.55 + a
Group 3: Excavator; Backhoe/Excavator under 2 cubic yards; Cranes (under 100 ton rated capacity), Grader/Blade; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar);Grader Operator; Bulldozer Fine Grade. (slopes, shaping, laser or GPS, etc.). (Trade License Required)	37.49	23.55 + a

Group 4: Trenching Machines; Lighter Derrick; Concrete Finishing Machine; CMI Machine or Similar; Koehring Loader (Skooper).	37.10	23.55 + a
Group 5: Specialty Railroad Equipment; Asphalt Paver; Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps; Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24" Mandrell)	36.51	23.55 + a
Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller; Pile Testing Machine.	36.51	23.55 + a
Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).	36.20	23.55 + a
Group 7: Asphalt roller, concrete saws and cutters (ride on types), vermeer concrete cutter, Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24" and under Mandrell).	35.86	23.55 + a
Group 8: Mechanic, grease truck operator, hydroblaster; barrier mover; power stone spreader; welding; work boat under 26 ft.; transfer machine.	35.46	23.55 + a

Group 9: Front end loader (under 3 cubic yards), skid steer loader regardless of attachments, (Bobcat or Similar): forklift, power chipper; landscape equipment (including Hydroseeder).	35.03	23.55 + a
Group 10: Vibratory hammer; ice machine; diesel and air, hammer, etc.	32.99	23.55 + a
Group 11: Conveyor, earth roller, power pavement breaker (whiphammer), robot demolition equipment.	32.99	23.55 + a
Group 12: Wellpoint operator.	32.93	23.55 + a
Group 13: Compressor battery operator.	32.35	23.55 + a
Group 14: Elevator operator; tow motor operator (solid tire no rough terrain).	31.21	23.55 + a

Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.	30.80	23.55 + a
Group 16: Maintenance Engineer/Oiler.	30.15	23.55 + a
Group 17: Portable asphalt plant operator; portable crusher plant operator; portable concrete plant operator.	34.46	23.55 + a
Group 18: Power safety boat; vacuum truck; zim mixer; sweeper; (Minimum for any job requiring a CDL license).	32.04	23.55 + a
------PAINTERS (Including Drywall Finishing)------		
10a) Brush and Roller	32.02	20.15

As of: **Friday, August 12, 2016**

10b) Taping Only/Drywall Finishing	32.77	20.15
10c) Paperhanger and Red Label	32.52	20.15
10e) Blast and Spray	35.02	20.15
11) Plumber (excluding HVAC pipe installation) (Trade License required: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2)	40.62	29.71
12) Well Digger, Pile Testing Machine	33.01	19.40 + a
13) Roofer (composition)	34.12	18.58

As of: **Friday, August 12, 2016**

14) Roofer (slate & tile)	34.62	18.58
15) Sheetmetal Worker (Trade License required for HVAC and Ductwork: SM-1,SM-2,SM-3,SM-4,SM-5,SM-6)	36.00	34.51
16) Pipefitter (Including HVAC work) (Trade License required: S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4, G-1, G-2, G-8 & G-9)	40.62	29.71
------TRUCK DRIVERS------		
17a) 2 Axle	28.83	21.39 + a
17b) 3 Axle, 2 Axle Ready Mix	28.93	21.39 + a

As of: **Friday, August 12, 2016**

17c) 3 Axle Ready Mix	28.98	21.39 + a
17d) 4 Axle, Heavy Duty Trailer up to 40 tons	29.03	21.39 + a
17e) 4 Axle Ready Mix	29.08	21.39 + a
17f) Heavy Duty Trailer (40 Tons and Over)	29.28	21.39 + a
17g) Specialized Earth Moving Equipment (Other Than Conventional Type on-the-Road Trucks and Semi-Trailers, Including Euclids)	29.08	21.39 + a
18) Sprinkler Fitter (Trade License required: F-1,2,3,4)	41.37	20.77 + a

19) Theatrical Stage Journeyman	25.76	7.34

Welders: Rate for craft to which welding is incidental.

**Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.*

***Note: Hazardous waste premium $3.00 per hour over classified rate*

ALL Cranes: When crane operator is operating equipment that requires a fully licensed crane operator to operate he receives an extra $3.00 premium in addition to the hourly wage rate and benefit contributions:

1) Crane handling or erecting structural steel or stone; hoisting engineer (2 drums or over)

2) Cranes (100 ton rate capacity and over) Bauer Drill/Caisson

3) Cranes (under 100 ton rated capacity)

Crane with 150 ft. boom (including jib) - $1.50 extra
Crane with 200 ft. boom (including jib) - $2.50 extra
Crane with 250 ft. boom (including jib) - $5.00 extra
Crane with 300 ft. boom (including jib) - $7.00 extra
Crane with 400 ft. boom (including jib) - $10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol. For those without internet access, please contact the division listed below.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

Contracting Agencies are under no obligation pursuant to State labor law to pay any increase due to the annual adjustment provision.

As of: **Friday, August 12, 2016**

Project: AW Stanley Park And Aquatic Facilities Improvements

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)

Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

~~Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: **Friday, August 12, 2016**

City of New Britain

General Conditions

Contents*

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*See alphabetical index at end

1. Contract and Contract Documents

The Plans, Specifications and Addenda, hereinafter enumerated in Paragraph 1 of the Supplemental General Conditions, shall form part of this Contract; and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

2. Definitions

The following terms as used in this contract are respectively defined as follows:

(a) "Contractor": A person, firm or corporation with whom the contract is made by the Owner.
(b) "Subcontractor": A person, firm or corporation supplying labor and materials or only labor for work at the site of the project for, and under separate contract or agreement with, the Contractor.
(c) "Work on (at) the project": Work to be performed at the location of the project including the transportation of materials and supplies to or from the location of the project, by employees of the Contractor and any Subcontractor.

3. Additional Instructions and Detail Drawings

The Contractor will be furnished additional instructions and detail drawings as necessary to carry out the work included in the contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions. The Contractor and the Architect/Engineer will prepare jointly (a) a schedule, fixing the dates at which special detail drawings will be required, such drawings, if any, to be furnished by the Architect/Engineer in accordance with said schedule, and (b) a schedule fixing the respective dates for the submission of shop drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment, and the completion of the various parts of the work; each such schedule to be subject to change from time to time in accordance with the progress of the work.

4. Shop or Setting Drawings

The Contractor shall submit promptly to the Architect/Engineer two copies of each shop or setting drawing prepared in accordance with the schedule predetermined as aforesaid. After examination of such drawings by the Architect/Engineer and the return thereof, the Contractor shall make such corrections to the drawings as have been indicated and shall furnish the Architect/Engineer with two corrected copies. If requested by the Architect/Engineer the Contractor must furnish additional copies. Regardless of corrections made in or approval given to such drawings by the Architect/ Engineer, the Contractor will nevertheless be responsible for the accuracy of such drawings and for their conformity to the Plans and Specifications, unless he notifies the Architect/Engineer in writing of any deviations at the time he furnishes such drawings.

5. Materials, Services, and Facilities

(a) It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all material, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

(b) Any work necessary to be performed after regular working hours, on Sundays or Legal Holidays, shall be performed without additional expense to the Owner.

6. Contractor's Title to Materials

No materials or supplies for the work shall be purchased by the Contractor or by any Sub-contractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims or encumbrances.

7. Inspection and Testing of Materials

(a) All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. The Owner will pay for all laboratory inspection service direct, and not as part of the contract.

(b) Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

8. "Or Equal" Clause

Whenever a material, article or piece of equipment is identified on the plans or in the specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and, any material, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable, provided the material, article, or equipment so proposed, is, in the opinion of the Architect/Engineer, of equal substance and function. It shall not be purchased or installed by the contractor without the Architect/Engineer's written approval.

9. Patents

(a) The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents.

(b) License or Royalty Fees: License and/or Royalty Fees for the use of a process which is authorized by the Owner of the project must be reasonable, and paid to the holder of the patent, or his authorized licensee, direct by the Owner and not by or through the Contractor.

(c) If the contractor uses any design, devise or materials covered by letters, patent, or copyright, he shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, devise or materials, it is mutually agreed and understood that, without exception, the contract prices shall include all royalties or cost arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his Sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

10. Surveys, Permits, and Regulations

Unless otherwise expressly provided for in the Specifications, the Owner will furnish to the Contractor all surveys necessary for the execution of the work.

The Contractor shall procure and pay all permits, licenses and approvals necessary for the execution of his contract.

The Contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to performance of the work, the protection of adjacent property, and the maintenance of passage- ways, guard fences or other protective facilities.

11. Contractor's Obligations

The Contractor shall and will, in good workmanlike manner, do and perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this contract, within the time herein specified, in accordance with the provisions of this contract and said specifications and in accordance with the plans and drawings covered by this contract any and all supplemental
plans and drawings, and in accordance with the directions of the Architect/Engineer as given from time to time during the progress of the work. He shall furnish, erect, maintain, and remove such construction plant and such temporary works as may be required.

The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the contract and specifications, and shall do, carry on, and complete the entire work to the satisfaction of the Architect/Engineer and the Owner.

12. Weather Conditions

In the event of temporary suspension of work, or during inclement weather, or whenever the Architect/Engineer shall direct, the Contractor will, and will cause his subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Architect/ Engineer, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors so to protect his work, such materials shall be removed and replaced at the expense of the Contractor.

13. Protection of Work and Property~Emergency

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this contract. He shall at all times safely guard and protect his own work, and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury unless such be caused directly by errors contained in the contract or by the Owner, or his duly authorized representatives.
In case of an emergency which threatens loss or injury of property, and/or safety of life, the Contractor will be allowed to act, without previous instructions from the Architect/Engineer, in a diligent manner. He shall notify the Architect/Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the Architect/Engineer for approval.

Where the Contractor has not taken action but has notified the Architect/Engineer of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Architect/Engineer.

The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Paragraph 17 of the General Conditions.

14. Inspection

The authorized representatives and agents of the Department of Housing and Urban Development shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

15. Reports, Records and Data

The Contractor shall submit to the Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.

16. Superintendence by Contractor

At the site of the work the Contractor shall employ a construction superintendent or foreman who shall have full authority to act for the Contractor. It is understood that such representative shall be acceptable to the Architect/Engineer and shall be one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll.

17. Changes (48 CFR Ch. 1 (Aug 1987)(10-1-90 Edition))

(a) The Owner may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes -

(1) In the specifications (including drawings and designs);
(2) In the method or manner of performance of the work;
(3) In the Owner-furnished facilities, equipment, materials, services, or site; or
(4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction interpretation or determination) from the Owner that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Owner written notice stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Owner shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Owner shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Owner is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Owner a written statement describing the general nature and amount of proposal, unless this period is extended by the Owner. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

18. Disputes

(a) All disputes arising under this contract or its interpretation, whether involving law or fact or both, or extra work, and all claims for alleged breach of contract shall within ten (10) days of commencement of the dispute be presented by the Contractor to the Owner for decision. All papers pertaining to the claims shall be filed in quadruplicate. Such notice need not detail the amount of the claim, but shall state the facts surrounding the claim in sufficient detail to identify the claim, together with its character and scope. In the meantime the Contractor shall proceed with the work as directed. Any claim not presented within the time limit specified within this paragraph shall be deemed to have been waived, except that if the claim is of a continuing character and notice of the claim is not given within ten days of its commencement, the claim will be considered only for a period commencing ten days prior to the receipt of the Owner of notice thereof.

(b) The Contractor shall submit in detail his claim and proof thereof. Each decision by the Owner will be in writing and will be mailed to the Contractor by registered mail, return receipt requested.

(c) If the Contractor does not agree with any decision of the Owner, he shall in no case allow the dispute to delay the work but shall notify the Owner promptly that he is proceeding with the work under protest and he may then except the matter in question from the final release.

19. Arbitration and Litigation

Any controversy or claim arising out of or relating to this contract, or the breach thereof, shall, at the option of the Owner, be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association and judgment upon the award rendered by the Arbitrator(s) may be entered in any court having jurisdiction thereof. The Owner shall exercise its option to arbitrate concurrent with the rendering of its final decision on the claim. Should it fail to render a final decision within the prescribed time or fail to exercise its option, the claim will be determined in accordance with the Rules of the American Arbitration Association as hereinbefore stated.

20. Time for Completion and Liquidated Damages

It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the contract of the work to be done hereunder are ESSENTIAL CONDITIONS of this contract; and it is further mutually understood and agreed that the work embraced in this contract shall be commenced on a date to be specified in the "Notice to Proceed."

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

If the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the contract for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and as ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

It is further agreed that time is of the essence of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this contract.

Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; Provided, further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

(a) To any preference, priority or allocation order duly issued by the Government;
(b) To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, flood, epidemics, quarantine restrictions, strikes, freight embargoes, and severe weather; and
(c) To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article:
Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.

21. Correction of Work

All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Architect/Engineer who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture, and methods of construction for the purposes for which they are used. Should they fail to meet his approval they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the Contractor as his own expense. Rejected material shall immediately be removed from the site. If, in the opinion of the Architect/Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the Contract Documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as in the judgement of the Architect/Engineer shall be equitable.

22. Subsurface Conditions Found Different

Should the Contractor encounter sub-surface and/or latent conditions at the site materially differing from those shown on the Plans or indicated in the Specifications, he shall immediately give notice to the Architect/Engineer of such conditions before they are disturbed. The Architect/Engineer will thereupon promptly investigate the conditions, and if he finds that they materially differ from those shown on the Plans and/or indicated in the Specifications he will at once make such changes in the Plans and/or Specifications

as he may find necessary, any increase or decrease of cost resulting from such changes to be adjusted in the manner provided in Paragraph 17 of the General Conditions.

23. Right of the Owner to Terminate Contract

In the event that any of the provisions of this contract are violated by the Contractor, or by any of his Subcontractors, the Owner may serve written notice upon the Contractor and the Surety of its intention to terminate the contract, such notices to contain the reasons for such intention to terminate the contract, and unless within ten (10) days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement of correction be made, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the Surety and the Contractor and the Surety shall have the right to take over and perform the contract; Provided, however, that if the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such Surety of notice of termination, the Owner may take over the work and prosecute the same to completion by contract or by force account for the account and at the expense of the Contractor and the Contractor and his Surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefor.

24. Construction Schedule and Periodic Estimates

Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the progress schedule. The Contractor shall also furnish on forms to be supplied by the Owner (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

25. Payments to Contractor

(a) Not later than the 15th day of each calendar month the Owner shall make a progress payment to the Contractor on the basis of a duly certified and approved estimate of the work performed during the preceding calendar month under this contract; but to insure the proper performance of this contract, the Owner shall retain five percent (5%) of the amount of each estimate until final completion and acceptance of all work covered by this contract: Provided, that the Contractor shall submit his estimate not later than the first

day of the month; Provided, further, that the Owner may at any time after fifty percent (50%) of the work has been completed, if it finds that satisfactory progress is being made, may make any of the remaining progress payments in full; Provided, further, that on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment may be made in full, including retained percentages thereon, less authorized deductions.

(b) In preparing estimates the material delivered on the site and preparatory work done may be taken into consideration.

(c) All material and work covered by partial payments made shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Owner to require the fulfillment of all of the terms of the contract.

(d) Owner's Right to Withhold Certain Amounts and Make Application Thereof: The Contractor agrees that he will indemnify and save the Owner harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material men and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature herein above designated have been paid, discharged, or waived. If the Contractor fails so to do, then the Owner may, after having served written notice on the said Contractor, either pay unpaid bills, of which the Owner has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of this contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor or his Surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner, shall be considered as a payment made under the contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

26. Acceptance of Final Payment Constitutes Release

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor for all things done or furnished in connection with this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payments, however, final or otherwise, shall operate to release the Contractor or his Sureties from any obligations under this contract or the Performance and Payment Bond.

27. Payments by Contractor

The Contractor shall pay (a) for all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered, (b) for all materials, tools, and other expendable equipment to the extent of ninety percent (90%) of the cost thereof, not later that the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at the site of the project, and the balance of the cost thereof, not later than the 30th day following the completion of that part of the work in or on which such materials, tools, and equipment are incorporated or used, and (c) to each of his Subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his Subcontractors to the extent of each subcontractor's interest therein.

28. Insurance

The Contractor shall not commence work under this contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his sub-contract until the insurance required of the Subcontractor has been so obtained and approved.

(a) Compensation Insurance: The Contractor shall procure and shall maintain during the life of this contract Workers' Compensation Insurance as required by applicable State or territorial law for all of his employees to be engaged in work at the site of the project under this contract and, in case of any such work sublet, the Contractor shall require the Subcontractor similarly to provide Workers' Compensation Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractor's Workers' Compensation Insurance. In case any class of employees engaged in hazardous work on the project under this contract is not protected under the Workers' Compensation Statute, the Contractor shall provide and shall cause each subcontractor to provide adequate employer's liability insurance for the protection of such of his employees as are not otherwise protected.

(b) Contractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance: The Contractor shall procure and shall maintain during the life of this contract Contractor's Public Liability Insurance, Contractor's Property Damage Insurance and Vehicle Liability Insurance in the amounts specified in the Supplemental General Conditions.

(c) Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance: The Contractor shall either (1) require each of his Subcontractors to procure and maintain during the life of his subcontract, Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance of the type and in the amounts specified in the Supplemental General Conditions specified in subparagraph (b) hereof, or (2) insure the activities of this policy, specified in subparagraph (b) hereof.

(d) Scope of Insurance and Special Hazards: The insurance required under subparagraphs (b) and (c) hereof shall provide adequate protection for the Contractor and his

Subcontractors, respectively, against damage claims which may arise from operations under this contract, whether such operations be by the insured or by anyone directly or indirectly employed by him and, also against any of the special hazards which may be encountered in the performance of this contract as enumerated in the Supplemental General Conditions.

(e) Builder's Risk Insurance (Fire and Extended Coverage): Until the project is completed and accepted by the Owner, the Owner or the Contractor is required to maintain Builder's Risk Insurance (fire and extended coverage) on a 100 percent completed value basis on the insurable portion of the project for the benefit of the Owner, the Contractor, Subcontractors as their interests may appear. The Contractor shall not include any costs for Builder's Risk Insurance (fire and extended coverage) premiums during construction unless the Contractor is required to provide such insurance; however, this provision shall not release the Contractor from his obligation to complete, according to plans and specifications, the project covered by the contract, and the Contractor and his Surety shall be obligated to full performance of the Contractor's undertaking.

(f) Proof of Carriage of Insurance: The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement; "The insurance covered by this certificate will not be canceled or materially altered, except after ten (10) days written notice has been received by the Owner." The City of New Britain and the Consolidated School District" must be shown on the certificate(s) as "Additional Insured".

29. Contract Security

The Contractor shall furnish a performance bond in an amount at least equal to one hundred percent (100%) of the contract prices as security for the faithful performance of this contract and also a payment bond in an amount not less than one hundred percent (100%) of the contract price or in a penal sum not less than that prescribed by State, territorial or local law, as security for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract. The performance bond and the payment bond may be in one or in separate instruments in accordance with local law.

30. Additional or Substitute Bond

If at any time the Owner for justifiable cause shall be or become dissatisfied with any Surety or Sureties, then upon the Performance or Payment Bonds, the Contractor shall within five (5) days after notice from the Owner so to do, substitute an acceptable bond (or bonds) in such form and sum and signed by such other Surety or Sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new Surety or Sureties shall have furnished such an acceptable bond to the Owner.

31. Assignments

The Contractor shall not assign the whole or any part of this contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or part of any monies due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this contract.

32. Mutual Responsibility of Contractors

If, through acts of neglect on the part of the Contractor, any other Contractor or any Subcontractor shall suffer loss or damage on the work, the Contractor agrees to settle with such other Contractor or Subcontractors by agreement or arbitration if such other Contractor or Subcontractor will so settle. If such other Contractor or Subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.

33. Separate Contract

The Contractor shall coordinate his operations with those of other Contractors. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the work. The Contractor, including his Subcontractors, shall keep informed of the progress and the detail work of other Contractors and shall notify the Architect/Engineer immediately of lack of progress or defective workmanship on the part of other Contractors. Failure of a Contractor to keep informed of the work progressing on the site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by him of the status of the work as being satisfactory for proper coordination with his own work.

34. Subcontracting

(a) The Contractor may utilize the services of specialty Subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty Subcontractors.
(b) The Contractor shall not award any work to any Subcontractor without prior written approval of the Owner, which approval will not be given until the Contractor submits to the Owner a written statement concerning the proposed award to the Subcontractor, which statement shall contain information as the Owner may require.
(c) The Contractor shall be as fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

(d) The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the General Conditions and other Contract Documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

(e) Nothing contained in this contract shall create any contractual relation between any Subcontractor and the Owner.

35. Architect/Engineer's Authority

The Architect/Engineer shall give all orders and directions contemplated under this contract and specifications, relative to the execution of the work. The Architect/Engineer shall determine the amount, quality, acceptability, and fitness of the several kinds of work and materials which are to be paid for under this contract and shall decide all questions which may arise in relation to said work and the construction thereof. The Architect/Engineer's estimates and decisions shall be final and conclusive, except as herein otherwise expressly provided. In case any question shall arise between the parties hereto relative to said contract or specifications, the determination or decision of the Architect/Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.

The Architect/Engineer shall decide the meaning and intent of any portion of the specifications and of any plans or drawings where the same may be found obscure or be in dispute. Any differences or conflicts in regard to their work which may arise between the Contractor under this contract and other Contractors performing work for the Owner shall be adjusted and determined by the Architect/Engineer.

36. Stated Allowances

The Contractor shall include in his proposal the cash allowances stated in the Supplemental General Conditions. The Contractor shall purchase the "Allowed Materials" as directed by the Owner on the basis of the lowest and best bid of at lease three competitive bids. If the actual price for purchasing the "Allowed Materials" is more or less than the "Cash Allowance," the contract price shall be adjusted accordingly. The adjustment in contract price shall be made on the basis of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the "Allowed Materials" shall be included in the applicable sections of the Contract Specifications covering this work.

37. Use of Premises and Removal of Debris

The Contractor expressly undertakes at his own expense:

(a) to take every precaution against injuries to persons or damage to property;
(b) to store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his work or the work of any other contractor's;
(c) to place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work;
(d) to clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the work shall present a neat, orderly and workmanlike appearance;
(e) before final payment to remove all surplus material, false- work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in a neat, orderly condition;
(f) to effect all cutting, fitting or patching of his work required to make the same to conform to the plans and specifications and, except with the consent of the Architect/ Engineer, not to cut or otherwise alter the work of any other Contractor.

38. Quantities of Estimate

Wherever the estimated quantities of work to be done and materials to be furnished under this contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated by this contract, and such increase or diminution shall in no way vitiate this contract, nor shall any such increase or diminution give cause for claims or liability for damages.

39. Lands and Rights-of-Way

Prior to the start of construction, the Owner shall obtain all lands and rights-of-way necessary for the carrying out and completion of work to be performed under this contract.

40. General Guaranty

Neither the final certificate of payment nor any provision in the Contract Documents, nor partial or entire occupancy of the premises by the Owner, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.

41. Notice and Service Thereof

Any notice to any Contractor from the Owner relative to any part of this contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted, by certified or registered mail, to the said Contractor at his last given address, or delivered in person to the said Contractor or his authorized representative on the work.

42. Provisions Required by Law Deemed Inserted

Each and every provision of law and clause required by law to be inserted in this 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 or correction.

43. Protection of Lives and Health

In order to protect the lives and health of his employees under the contract, the Contractor shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the contract. He alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation.

44. Subcontracts

The Contractor will insert in any subcontracts the sections 52 through 56 contained herein and such other clauses as the Department of Housing and Urban Development and /or the City of New Britain may, by instructions, require, and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

45. Equal Employment Opportunity

During the performance of this contract the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color or national origin. 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 to be provided setting forth the provisions of this nondiscrimination clause.

(b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

(c) The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the labor union or workers' representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the City of New Britain and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of such rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further contracts or Federally assisted construction contracts, in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the City of New Britain may direct as a means of enforcing such provisions, including sanction for noncompliance: Provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendors as a result of such direction by the City of New Britain; the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

46. Interest of Member of or Delegate to Congress

No member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

47. Other Prohibited Interests

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, architect, attorney, engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any such legislative, executive, supervisory or other similar functions in connection of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

48. Use and Occupancy Prior to Acceptance by Owner

The Contractor agrees to the use and occupancy of a portion or unit of the project before formal acceptance by the Owner, provided the Owner:

(a) Secures written consent of the Contractor except in the event, in the opinion of the Architect/Engineer, the Contractor is chargeable with unwarranted delay in final cleanup of punch list items or other contract requirements;
(b) Secures endorsement from the insurance-carrier and consent of the Surety permitting occupancy of the building or use of the project during the remaining period of construction; or
(c) When the project consists of more than one building, and one of the buildings is occupied, secures permanent fire and extended coverage insurance, including a permit to complete construction. Consent of the Surety must also be obtained.

49. Photographs of the Project

If required by the Owner, the Contractor shall furnish videos/ photographs of the project.

50. Suspension of Work

Should the Owner be prevented or enjoined from proceeding with work either before or after the start of construction by reason of any litigation or other reason beyond the control of the Owner, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of the work will be extended to such reasonable time as the Owner may be determined will compensate for time lost by such delay with such determination to be set forth in writing.

51. Minimum Wages

(a) The Contractor shall post at appropriate conspicuous points at the site of the project a schedule showing all determined minimum wage rates for the various classes of laborers and mechanics to be engaged in work on the project under this contract and all deductions, if any, required by law to be made from unpaid wages actually earned by the laborers and mechanics so engaged.

(b) All mechanics and laborers employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amounts due at time of payment computed at wage rates not less than those contained in the wage determination decision of the Secretary of Labor, which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. For the purpose of this clause, contributions made or costs reasonably anticipated under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv). Also for the purpose of this clause, regular contributions made or costs incurred for more than a weekly period under plans, funds, or programs, but covering the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

(c) The City of New Britain shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract, shall be classified or reclassified conformably to the wage determination, and a report of the action taken shall be sent by the City of New Britain to the Secretary of Labor. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question accompanied by the recommendation of the City of New Britain shall be referred to the Secretary for final determination.

(d) The City of New Britain shall require, whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly wage rate and the Contractor is obligated to pay a cash equivalent of such a fringe benefit, an hourly cash equivalent thereof to be established. In the event the interested parties cannot agree upon a cash equivalent of the fringe benefit, the question, accompanied by the recommendation of the City of New Britain, shall be referred to the Secretary of Labor for determination.

(e) The Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, or any bona fide fringe benefits not expressly listed in Section 1(b)(2) of the Davis-Bacon Act or otherwise not listed in the wage determination decision of the Secretary of Labor which is included in this contract, only when the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. Whenever practicable, the Contractor should request the Secretary of Labor to make such findings before the making of the contract. In the case of unfunded plans and programs, the Secretary of Labor may

require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(f) The specified wage rates are minimum rates only, and the owner will not consider any claims for additional compensation made by the Contractor because of payment by the Contractor of any wage rate in excess of the applicable rate contained in this contract. All disputes in regard to the payment of wages in excess of those specified in this contract shall be adjusted by the Contractor.

(g) If the Contractor does not make payments to a trustee or other third person, he may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing benefits under a plan or program of a type expressly listed in the wage determination decision of the Secretary of Labor which is a part of this contract: Provided however, the Secretary of Labor has found upon the written request of the Contractor that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

52. Withholding of Payments

The City of New Britain may withhold or cause to be withheld from the Contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics employed by the Contractor or any Sub- contractor on the work the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic employed or working on the site of the work, all or part of the wages required by the contract, the City of New Britain may, after written notice to the Contractor or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

53. Payrolls and Basic Records

(a) Payrolls and basic records relating thereto will be maintained during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records will contain the name and address of each such employee, his correct classification, rates of pay (including rates of contributions or costs anticipated of the types described in section 1(b)(2) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(b) The Contractor will submit weekly a copy of all payrolls to the Owner, for transmission to the City of New Britain. The copy shall be accompanied by a statement signed by the employer or his agent indicating that the payrolls are correct and complete, that the wage rates contained therein are not less than those determined by the Secretary of Labor and that the classifications set forth for each laborer or mechanic conform with the work he performed. A submission of a "Weekly Statement of Compliance" which is required under this contract and the Copeland regulations of the Secretary of Labor (29 CFR, Part 3) and the filing with the initial payroll or any subsequent payroll of a copy of any findings by the Secretary of Labor under 29 CFR 5.5(a)(l)(iv) shall satisfy this requirement. The Prime Contractor shall be responsible for the submission of copies of payrolls of all Subcontractors. The Contractor shall make the records required under the labor standards clauses of the contract available for inspection by authorized representatives of the City of New Britain and the Department of Labor, and shall permit such representatives to interview employees during working hours on the job.

54. Apprentices

Apprentices shall be permitted to work as such only when they are registered, individually, under a bona fide apprenticeship agency which is recognized by the Bureau of Apprenticeship and Training, United States Department of Labor; or, if no such recognized agency exists in a State, under a program registered with the Bureau of Apprentice- ship and Training, United States Department of Labor. The allowable ratio of apprentices to journeymen in any craft classification shall not be greater than the ratio permitted to the Contractor as to his entire work force under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered as above, shall be paid the wage rate determined by the Secretary of Labor for the classification of work he actually performed. The Contractor or Subcontractor will be required to furnish to the City of New Britain written evidence of the registration of his program and apprentices as well as of the appropriate ratios and wage rates, for the area of construction, prior to using any apprentices on the contract work.

55. Compliance with the Copeland Anti-Kickback Act and Regulations

The Contractor shall comply with the Copeland Anti-Kickback Act and Regulations of the Secretary of Labor (29 CFR, Part 3) which are herein incorporated by reference.

56. Overtime

(a) No Contractor or Subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics, including watchmen and guards, shall require or permit any laborer or mechanic in any workweek in which he is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all hours worked in excess of forty hours in such workweek, as the case may be;

(b) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (l), the Contractor and any Subcontractor responsible therefor shall be liable to any affected employee for his unpaid wages. In addition, such Contractor and Subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the clause set forth in subparagraph (l), in the sum of $10 for each calendar day on which such employee was required or permitted to work in excess of the standard work week of forty hours without payment of the overtime wages required by the clause set forth in subparagraph (l).

(c) Withholding for unpaid wages and liquidated damages. The City of New Britain may withhold or cause to be withheld, from any monies payable on account of work performed by the Contractor or Subcontractor, such sums as may administratively be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2).

(d) Subcontracts. The Contractor shall insert in any subcontracts and clauses set forth in subparagraphs (a), (b), and (c) of this paragraph and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

57. Signs

The General Contractor shall erect a sign at the project site identifying the project and indicating that the Government is participating in the development of the project. The project sign shall be substantially in accordance with instructions provided by the City of New Britain, made from 3/4 inch plywood, place in a prominent location, and maintained in good condition until completion of the project.

58. Employment Practices

The Contractor (l) shall, to the greatest extent practicable, follow hiring and employment practices for work on the project which will provide new job opportunities for the unemployed and underemployed, and (2) shall insert or cause to be inserted the same provision in each construction subcontract.

59. Contract Termination; Debarment

A breach of Sections 45 and 52 through 56 may be grounds for termination of the contract, and for debarment as provided in 29 CFR 5.6.

60. Termination for Convenience of the Owner

(a) The Owner may terminate performance of work under this contract in whole, or from time to time, in part if the Owner determines that termination is in its best

interest. The Owner shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as directed by the Owner, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.

(3) Terminate all subcontracts to the extent they relate to the work terminated.

(4) Assign to the Owner, as directed by the Owner, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Owner shall have the right to settle or pay any termination settlement proposal arising out of those terminations.

(5) With approval or ratification to the extent required by the Owner, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts;the approval or ratification will be final for the purposes of this clause.

(6) As directed by the Owner, transfer title and deliver to the Owner:

(i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and;

(ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Owner.

(7) Complete performance of the work not terminated.

(8) Take any action that may be necessary, or that the Owner may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Owner has or may acquire an interest.

(9) Use its best efforts to sell, as directed or authorized by the Owner, any property of the types referred to in subparagraph (6) above; provided, however, that the Contractor:

(i) is not required to extend credit to any purchaser, and;

(ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Owner. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Owner under this contract, credited to the price or cost of the work, or paid in any other manner as directed by the Owner.

(c) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Owner a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Owner. The Contractor may request the Owner to remove those items or enter into an agreement for their storage. Within fifteen days, the Owner will accept title to

those items and remove them or enter into a storage agreement. The Owner may verify the list upon removal of the items, or if stored, within 45 days of the submission of the list, and shall correct the list, as necessary, before final settlement.

(d) After termination, the Contractor shall submit a final termination settlement proposal to the Owner in the form and with the certification prescribed by the Owner. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Owner upon written request of the Contractor within this 1 year period. However, if the Owner determines that the facts justify it, a termination settlement proposal may be received and acted upon after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Owner may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(e) Subject to paragraph (d) above, the Contractor and the Owner may agree upon the whole or any part of the amount to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (e) or (f) below, exclusive of costs shown in subparagraph (f)(3), may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be amended and the Contractor paid the agreed amount. Paragraph (f) below shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(f) If the Contractor and the Owner fail to agree on the whole amount to be paid because of the termination of work, the Owner shall pay the Contractor the amounts determined by the Owner as follows, but without duplication of any amounts agreed on under paragraph (e) above:

(1) The contract price for completed supplies or services accepted by the Owner (or sold or acquired under subparagraph (b)(9) above) not previously paid for, adjusted for any saving of freight and other charges.

(2) The total of-

(i) The costs incurred in the performance of the work terminated, including initial cost and preparatory expense allocable thereto. but excluding any costs attributable to supplies or services paid or to be paid under subparagraph (f)(1) above;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (i) above; and

(iii) A sum, as profit on subdivision (i) above, determined by the Owner under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Owner shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(3) The reasonable costs of settlement of the work terminated, including-

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of the termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage transportation and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(g) Except for normal spoilage, and except to the extent that the Owner expressly assumed the risk of loss, the Owner shall exclude from the amounts payable to the Contractor under paragraph (f) above, the fair value, as determined by the Owner, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Owner or to a buyer.

(h) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of the contract, shall govern all costs claimed or agreed to under this clause.

(i) The Contractor shall have the right of appeal, under the Disputes clause, for any determination made by the Owner under paragraph (d), (f), or (k), except that if the Contractor failed to submit the termination settlement proposal within the time provided in paragraph)d) or (k), and failed to request a time extension, there is no right of appeal. If the Owner has made a determination of the amount due under paragraph (d), (f), or (k), the Owner shall pay the Contractor (1) the amount determined by the Owner if there is no right of appeal or if no timely appeal has been taken, or (2) the amount finally determined on an appeal.

(j) In arriving at the amount due the Contractor under this clause, there shall be deducted-

(1) All unliquidated advanced or other payments to The Contractor under the terminated portion of this contract;

(2) Any claim which the Owner has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Owner.

(k) If the termination is partial, the Contractor may file a proposal with the Owner for an equitable adjustment of the price(s) of the continued portion of the contract. The Owner shall make any equitable adjustment agreed upon. any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Owner.

(l)

(1) The Owner may, under the terms and conditions it prescribes, make partial payments and payments against incurred by the Contractor for terminated portions of the contract, if the Owner believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Owner upon demand, computed with interest at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination proposal because of a retention or other disposition of termination inventory until 10 days after the date of retention or disposition, or a later date determined by the Owner because of the circumstances.

(m) Unless otherwise provided for in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this Contract three years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Owner, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Owner, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

61. Submission of a bid in response to this solicitation indicates that the Contractor understands and agrees to the terms of this section. Contractor shall comply with City of New Britain Code of Ordinances, Section 2-580, provisions following:

(1) The contractor shall hire residents of the city to perform the necessary labor where possible.

(2) In the event the contractor is restricted by labor contracts, or the required specific skills are not available in the city, the contractor may hire tradesmen and laborers who reside outside the city.

(3) In contracts for new construction of any public works project where the total cost of all work to be performed by all contractors and subcontractors exceeds four hundred thousand dollars ($400,000) and in contracts for remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project where the total of all work to be performed by all contractors and subcontractors exceeds one hundred thousand dollars ($100,000), all tradesmen and laborers hired to perform under the contract shall be paid at the prevailing rates for the same work in the same trade in the city and shall receive the fringe benefits normally offered at that time for the particular trade. “Prevailing rates” as used herein shall mean the latest rates published by the state labor department unless otherwise required to qualify for a federal grant pertaining to the contract.

As used herein, the term “contractor” shall include the general or prime contractor and shall include subcontractors performing work under the contract.

(4) All workers furnishing the goods and services in connection with the construction shall be properly classified as employees rather than independent contractors, causing them to be treated accordingly for the purposes of pay, benefits, workers’ compensation insurance coverage, social security taxes and income tax withholding.

(5) In contracts where the total cost of all work to be performed exceeds one

hundred thousand dollars ($100,000) and in all cases wherein one or more apprentices are employed, the employer shall be affiliated with a state-certified apprenticeship program.

(6) If a contractor signing a contract required under this subsection is found to have violated the provisions of this contract, it shall, if already paid by the City, reimburse to the City one percent of the payment that would have otherwise been owed by the City for every count of violation found. If a contractor signing a contract required under this subsection is found to have violated the provisions the contract and it has not already been paid by the City, the City shall withhold from payment one percent of the payment that would have otherwise been owed by the City for every count of violation found. For these purposes, each day of violation and each worker affected shall be deemed a separate count. Each construction contract entered into by the city shall recite that the contractor understands and agrees to the terms of this section.

(7) As used herein, the term "contractor" shall include the general or prime contractor and shall include subcontractors performing work under the contract.

Index to General Conditions

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City of New Britain

Index to General Conditions

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1. Selected Definitions

The following lists of selected definitions are included to supplement and amend those established in Section 1.01 of the reference specification "Form 816"; and said Section 1.01 is hereby made a part of this Article by Reference (including the abbreviations included therein).

Throughout these Contract Documents, the intent and meaning of the use of the following terms, or pronouns in place of them, shall be interpreted as follows (Note: the use of gender-specific pronouns or titles throughout the Contract Documents is for the sake of brevity, and are intended to refer to persons of either sex):

Bid - The offer or proposal of a Bidder submitted on the prescribed form, and in accordance with the provisions of the Bid Documents, setting forth the prices for the Project work.

Bid Documents - The documents, as issued by the Owner, enumerated in Article 3 of the Instructions to Bidders, from which, and in accordance therewith, the prospective Bidders are to base their respective Bids. All uses of the term "Contract Documents" shall be interpreted to mean the Bid Documents prior to Contract execution.

Bid item - An item of work specifically described in the Bid for which a price, either unit or lump sum, is provided.

Bidder - Any legal entity submitting a bid for the Project work.

Contract - The written agreement between the Owner and the Contractor regarding the prosecution of the Project work.

Contract Documents - The set of documents which form the written agreement between the Owner and the Contractor. The Contract Documents consist of the documents enumerated in Article 3 of the Contract together with any documents issued subsequent to the execution of the Contract which become a part of the Contract Documents in accordance with the provisions of said enumerated documents. All uses of the term "Bid Documents" shall be interpreted to intend and mean the Contract Documents following execution of the Contract.

Contract Drawings - The official drawings of any and every kind, or reproductions thereof, having been provided and/or approved by the Engineer, which show the location, character, dimensions, or details of the Project Work. Use of the term "**Drawings**" within these Contract Documents, or otherwise related to the Contract, shall refer to and mean the Contract Drawings.

Contract Price - As defined in Article 2 of the Contract. Use of the term "**Contract Amount**" within these Contract Documents, or otherwise related to the Contract, shall refer to and mean the Contract Price.

Contract Time - The number of calendar days allowed for completion of the Project as set forth by the Contract, plus any authorized time extensions. In case of a calendar date of completion being specified in the Contract in lieu of a number of calendar days, the Contract Time shall mean the period of time between the issuance of the Notice to Proceed and said calendar date; and the Project shall be completed by said calendar date. Use of the term "**Time of Completion**" within these Contract Documents or otherwise related to the Contract shall refer to and mean the Contract Time.

Contractor - The legal entity so designated in the Contract, and who shall undertake the prosecution of the Project work in accordance with the terms of the Contract Documents, acting directly or through a duly authorized representative. The Contractor shall have control over the Project Work and the prosecution thereof, subject to the applicable provisions of the Contract Documents.

Engineer - The Director of Engineering of the City of New Britain, also known as the "City Engineer", or the person duly acting in that capacity, acting directly or through his designated representative(s) to the extents defined by the Contract Documents.

Extra Work - Any Project Work not included in or contemplated by the Contract Drawings or Specifications, or any other Contract Documents, but found essential to the satisfactory completion of the Project within its intended scope. By this definition, extra work involves a change to the Project Work, and therefore is covered by Article 17 of the General Conditions. Extra work for which a Change Order is not established in accordance with the provisions of said Article 17 shall be considered as unauthorized work.

Form 816 - The State of Connecticut Department of Transportation "Standard Specifications for Roads, Bridges and Incidental Construction, Form 816" together with the most recent "Supplemental Specifications" thereto.

Improvement Plans - The set of Contract Drawings, as designated in Article 2 of the Special Provisions, which have been prepared by or for the Engineer, and approved thereby, to show work and facilities specific to the Project; and which have been included in the Bid Documents. The Improvement Plans are issued as a set, and are included in the Bid Documents and/or Contract Documents as such. Use of the terms "**Plans**" or "**Improvement Drawings"** within these Contract Documents, or otherwise related to the Contract, shall refer to and mean the Improvement Plans.

Owner - The City of New Britain, acting through the City Purchasing Agent, and represented by the Director of the City department for which the Project is being performed, or his authorized representative.

Project - All activities and work contemplated and/or completed in association with the construction, modifications, repairs, and removal of facilities and/or features designated within and intended by the Contract Documents.

Project Site - The physical location of the facilities and/or features to be constructed, modified, repaired, or removed under the Project, and the area surrounding the same that is reasonably necessary for such construction, modifications, repairs, or removal. The construction limit line as designated on the Improvement Plans, if so designated, define the limits of the Project Site.

Project Work - The furnishing of all labor, materials, equipment, and incidentals necessary or convenient to the successful completion of the Project and the fulfillment of the duties and obligations imposed upon the Contractor by the Contract Documents.

Specifications - The minute descriptions of the details of the construction of various aspects of the Project Work which serve to complement the Contract Drawings. Such descriptions include, but are not limited to, the type, quality, and quantity of materials to be used, the methods and manner of performance of the work to be used, and the methods of measurement and payment to be used for the Project Work.

The Specifications consist of the **Special Technical Specifications**, a set of specifications created and/or compiled specifically for this Project; the **Reference Specifications**, as designated in Article 29 of the Instructions to Bidders; and any other document, or appropriate portion thereof, issued to the Contractor by the Engineer which serves the function of a specification as defined in the preceding paragraph.

Standard Specifications - The most recent edition of the "City of New Britain Standard Specifications for Municipal Construction"

Supervision - Where used to indicate supervision by the Engineer, supervision shall mean, and be limited to, the performance of obligations imposed upon and the exercise of rights granted to the Engineer by the Contract Documents, specifically including, but not limited to, those set forth in Articles 4 and 5 of these Supplemental General Conditions.

Where used to indicate the supervision by the Contractor, supervision shall mean the Contractor exercising his control over and proper superintendence of the Project Work and performing his obligations and responsibilities as set forth by the Contract Documents with respect to the Project Work and the prosecution thereof.

Unauthorized Work - Any work performed by the Contractor in association with the Project which qualifies as, is considered as, or is designated as unauthorized in accordance with the provisions of the Contract Documents. The Owner reserves the right to accept, make payment for, reject, and/or to order the Contractor to remove, repair, and/or replace all such work at his sole option. The Contractor shall be liable for any and all expenses associated with the inspection, removal, repair, and/or replacement of unauthorized work.

2. **Insurance Requirements**

The Contractor shall not commence work under this contract until he has obtained all necessary insurance and has filed certificates of insurance with the City. Each insurance policy shall contain a clause providing that the City must be notified sixty (60) days in advance in the event of any restrictive amendment, cancellation, or non-renewal.

Insurance must be in effect for the whole duration of the contract and for two (2) years following acceptance of the work by the City.

Failure to provide the required insurance and certificates may, at the option of the City, be held to be a willful and substantial breach of this contract.

The contractor agrees to provide original, completed certificate(s) of insurance to the Purchasing Agent evidencing the following coverages from an insurance conpany(ies) licensed by the State of Connecticut which have at least an "A-VIII" policyholders rating according to BEST Publications' latest edition of their Key Rating Guide:

Commercial General Liability:	
General Aggregate	**$2,000,000**
Prod./Compl. Operations Aggregate	**$2,000,000**
Occ. Aggregate	**$1,000,000**
Automobile Liability:	
Liability Limit	**$1,000,000**
Umbrella Excess Liability:	
Each Occurrence	**$1,000,000**
Aggregate	**$1,000,000**

Worker's Comp. and Employer's Liability:
$500,000 each accident
$500,000 disease policy
$500,000 disease accident limit

"The City of New Britain and the Consolidated School District and their agents, officials, and employees" must be named as "Additional Insured", and the Contractor agrees to provide replacement/renewal certificates at least 60 days prior to the expiration of the policy. Should any of the above described policies be cancelled before the expiration date, written notice must be made to the City 30 days prior to cancellation. The Contractor also agrees to name the City as Additional Insured on all insurance policies, except Workers Compensation and to provide a Waiver of Subrogation on all policies.

These certificates must be presented to the Purchasing Agent prior to execution of the contract or issuance of the purchase order as was as a replacement/renewal certificate at least 60 days prior to the expiration of the policy. Should any of the above-described policies be cancelled before the expiration date, written notice must be made to the City 30 days prior to cancellation.

If any policy is written on a "Claims Made" basis, the policy must be continually renewed for a minimum of two (2) years from the completion date of this contract. If the policy is replaced and/or the retroactive date changed, then the expiring policy must be endorsed to extend the reporting period for claims for the policy in effect during the contract for two (2) years from the completion date.

Contractor covenants and agrees to hold the City harmless and to indemnify the City from (I) and all claims arising from the performance of service enumerated herein, or any work or thing whatsoever done, or any condition created (other than by the City)during the term of this contract or any extensions thereof, but only to the extent caused by the negligent or otherwise wrongful act or omission of Contractor, its agent, employees, contractors or licensees and (II) all costs, expenses, liabilities incurred in or in connection with each such claim or action or proceeding brought Contractor covenants and agrees to hold the City harmless and to indemnify the City from (I) any thereon. In case an action or proceeding be brought against the City by reason of any such claim, Contractor, upon notice from the City, shall resist and defend such action claim or proceeding.

HOLD HARMLESS AGREEMENT:~The Contractor, its agents and assigns shall indemnify and hold harmless the City of New Britain, including but not limited to, its elected officials, its officers, and agents, ("the City") from any and all claims made against the City, including but not limited to, damages, awards, costs and reasonable attorney's fees, to the extent any such claim directly and proximately results from the wrongful willful or negligent performance of services by the Contractor during the Contractor's performance of this Agreement or any other Agreements of the Contractor entered into by reason thereof. The City agrees to give the Contractor prompt notice of any such claim and absent a conflict of interest, an opportunity to control the defense thereof.

This Agreement shall be binding on and inure to the benefit of the parties hereto and to their respective successors and assigns.

Failure to provide the required insurance and certificates may, at the option of the City, be held to be a willful and substantial breach of this contract.

3. **Minimum Wage Requirements**

The Contractor shall pay all tradesmen and laborers hired to perform work under the Contract not less than the prevailing Federal (if applicable) and State of Connecticut wage rates, including benefits, as set forth in the Bid Requirements and Conditions Document.

4. **Engineer - Authorities and Duties**

All work performed under this Contract is subject to the supervision of the Engineer on behalf of the Owner. The Engineer has the authority to enforce compliance with the Contract Drawings, Specifications, and all other Contract Documents, in all respects.

The Engineer shall decide all questions and disputes regarding the interpretation of the Drawings, Specifications, and other Contract Documents; as well as those regarding the quality and acceptability of materials furnished, work performed, manner of performance, rates of progress, and compliance with and acceptable fulfillment of all terms of the Contract, including compensation due thereunder. The Engineer shall also have the authority to, at his discretion, determine the points and times at which the Contractor may begin various aspects of the work and the order in which the work shall be prosecuted when the specific determination of the same is deemed to be in the best interest of the Owner.

The Engineer shall determine the amount and quality of work successfully completed by the Contractor at any time. His estimate of such completed work shall be basis for all payments by the Owner to the Contractor as compensation for Project Work completed.

All estimates and decisions of the Engineer shall be conclusive and final, except as otherwise expressly provided in the Contract Documents. In the case of the dispute of any estimate and/or decision of the Engineer by the Contractor, and proper assertion of the same in accordance with Articles 29 and 30 of these Supplemental General Conditions, such estimates and decisions of the Engineer shall not be final, but shall control until the subject dispute is properly and finally resolved. All directions of the Engineer shall be promptly and diligently carried out by the Contractor.

The Engineer shall also have all other authorities and duties as stated in the Contract Documents.

For certain projects, the Director of Engineering may designate, in writing to the Contractor, a Project Engineer, who shall be a supervisory staff person of the Bureau of Engineering. The Project Engineer shall have the authority to act as and for the Director of Engineering in all

matters governed by the Contract Documents, with the exception of the Acceptance and Award of Contract and the issuance of the Certificate of Completion.

For all projects, the Director of Engineering shall designate a Project Inspector. The authorities and duties of the Project Inspector shall be as stated in Article 5 of these Supplemental General Conditions. The Engineer shall also enjoy all powers and authorities granted to the Project Inspector by said Article 5, and otherwise granted by the Contract Documents.

5. Inspection

All materials furnished, equipment, facilities, and methods used, and work performed by the Contractor under this Contract, including any sampling and testing deemed necessary by the Engineer, is subject to inspection by the Project Inspector, and to the approval of the Engineer. The Contractor shall cooperate in all respects and provide any assistance and/or facilities as requested in the Project Inspector's efforts to perform such inspections. The Project Inspector is performing his duties under the direction of the Engineer and solely at the behest of and on behalf of the Owner; and solely for the purpose of protecting the Owner's interest in having the Project work performed in accordance with the Contract Documents.

The presence of the Project Inspector, or lack thereof, at the project site, or the inspection, or lack thereof, by the Project Inspector of any Project work performed by the Contractor, does not in any way release the Contractor from, or in any way alter, his responsibility for strict compliance with all requirements of the Drawings, Specifications, and other Contract Documents. In case of any dispute arising between the Contractor and the Project Inspector regarding the materials furnished, the manner of performing the work, or any other matter relating to the Contractor's compliance with the Contract Documents which may adversely affect work in progress, the Project Inspector has the authority to reject the material or stop the work until the question at issue can be referred to, and decided by, the Engineer. The Project Inspector is not authorized to revoke, alter, enlarge, relax or release any requirements of the Contract Documents nor to approve or accept any portion of the work, nor to issue instructions contrary to the Contract Documents. The Project Inspector shall in no case act as foreman or perform other duties for the Contractor. Any advice which the Inspector may give to the Contractor shall not be construed as binding the Engineer nor the Owner in any way, nor as in any way releasing the Contractor from fulfillment of the terms of the Contract Documents.

The Contractor shall keep the Project Inspector properly notified, to the satisfaction of the Project Inspector, of the time and place that he intends to perform any aspect of the work. Prior to commencing the Project Work, or any subject portion thereof, the Contractor shall obtain from the Engineer either directly or through the Project Inspector pertinent information and requirements regarding the level, methods, and frequency of inspection anticipated for any aspect of the work. The Contractor shall fully comply with the same and shall make adjustments to his scheduling and methods for the work accordingly. The Engineer may change said level, methods, and frequency of inspection required for any aspect of the work at any time as deemed fit to adjust

for actual levels and variations in the material conditions, working conditions, or workmanship; and the Contractor shall comply with any such changes.

The Engineer may not deem it necessary for the Project Inspector to be present at the project site at all times when project-related activities are taking place. The Contractor is reminded, however, that all work performed is subject to inspection and of his obligation to comply with the inspection requirements set forth in the previous paragraph. Any work performed in the absence of the Project Inspector is done at the Contractor's own risk, and shall be considered unauthorized. The Contractor is especially cautioned regarding the performance of unauthorized work which may not be readily inspected at a later time, including, but not limited to, underground utility installations, placement of base, fill and backfill, and concrete reinforcing and form work; and regarding the performance of subsequent work which may render previously performed unauthorized work difficult to inspect, or which may have to be removed and replaced in order to correct previously performed unauthorized work which may be found unacceptable by the Engineer.

The Contractor shall deliver, or have delivered, promptly to the Project Inspector copies of all written correspondence relating to the project from the Contractor. All oral correspondence between the Contractor and the Engineer regarding the project shall be directed through the Project Inspector, be conducted in the presence of the Project Inspector, or specific arrangements must be made between the Contractor and the Engineer to inform the Project Inspector of the proceedings of the correspondence.

6. **Superintendence by Contractor**

The Contractor shall, at all times during the occurrence of project activities, have present at the project site, as the Contractor's agent, a competent representative thoroughly experienced in the type of work being performed, who shall be termed the "Project Superintendent".

The Project Superintendent shall have full authority to act for the Contractor in supervision of the Project Work as well as in all other matters relating to the Project Work, to receive directions and orders from the Engineer, to promptly execute and carry out said directions and orders within the terms of the Contract Documents, and to supply all materials, equipment, tools, labor, and incidentals as may be required to appropriately perform the Project work. If the Contractor chooses, an alternate representative to act in place of the Project Superintendent in his absence may be designated. Said alternate shall have similar qualifications and equal authority to act as the Contractor's agent as does the Project Superintendent, and all references to the Project Superintendent herein apply likewise to the alternate when acting in such capacity.

The Project Superintendent and alternate are subject to the review of the Engineer. The name and qualifications of the proposed Project Superintendent and alternate shall be submitted to the Engineer prior to the commencement of work under the Contract by the Contractor. The Project Superintendent and alternate shall have the appropriate training and knowledge to be considered a "competent person" under the OSHA standards, regulations, instructions, and/or other guidelines applicable for, as a minimum, excavations and confined spaces.

The Project Superintendent shall remain in that capacity for the entirety of the Contract, or until his termination of employment with the Contractor or until his removal from such capacity is agreed to, in writing, by the Engineer. Should the Project Superintendent leave the employment of the Contractor, or otherwise be relieved of his duties as Project Superintendent, during the Contract, the alternate, if designated, shall become the Project Superintendent. If no alternate has been designated, the Contractor shall propose a new Project Superintendent to the Engineer for review through the proper submittal.

In the event that the Project Superintendent is absent from the project site, or cannot be rendered present at the location of certain subject work in a reasonable time, the Project Inspector has the authority to halt for reason of lack of superintendence, and until such time as proper superintendence is again provided, any work for which he may question the materials, workmanship, or other factor which may result in a final product not meeting the requirements of the Contract Documents. Any work performed while the Project Superintendent is absent from the project site shall be considered unauthorized due to lack of superintendence; and, therefore, the Contractor will be due no additional compensation for any additional work, down time, or delays as a result thereof, including any additional work, delays, or down time which may be a result of the Project Inspector halting work in accordance with this Article.

If, in the opinion of the Engineer, a communication problem develops between the Project Superintendent and the Project Inspector due to a language barrier, the Contractor shall take all steps deemed necessary by the Project Inspector, including providing an qualified interpreter, to resolve the problem to the satisfaction of the Project Inspector.

7. **Character of Workers, Methods, and Equipment**

The Contractor shall at all times employ sufficient labor and equipment for prosecuting the several classes of work to full completion in the manner and time required by the Contract Documents.

All workers shall have sufficient skill and experience to perform properly the work assigned to them, including the operation of equipment and other specialty or skilled tasks. Any person employed by the Contractor who, in the opinion of the Engineer, does not perform his work in a proper and skillful manner, or who is intemperate, disorderly, or non-courteous toward the public, or who in any way endangers person or property by performing his duties with less than appropriate care, shall, at the direction of the Engineer, be removed from the job forthwith by the Contractor, and shall not be employed again on any portion of the work without the written approval of the Engineer. Upon request, the Engineer shall confirm in writing any such oral direction.

The Contractor shall neither permit nor allow the introduction or use of intoxicating liquors or drugs upon or about the project site by any persons under their control or responsibility during performance of project work; nor shall they permit or allow any person under their control or

responsibility to perform any project work while under the influence of any intoxicating liquor or drug.

All equipment used on the work shall be in safe operating condition and shall be capable of performing its intended uses safely. The Contractor is solely responsible for the safety of all equipment used on Contract work and the manner in which it is used.

All equipment which is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet the requirements of the work and to produce a satisfactory quality of work in a timely manner. Equipment used on any portion of the project shall be such that its use or transportation will not cause any damage or injury to roadways or property; and shall be in accordance with all applicable laws, regulations, and restrictions. The Contractor shall remove no plant, materials, equipment, or other facilities from the project site without the Engineer's permission.

When the methods or equipment to be used by the Contractor in accomplishing the various aspects of the construction are not specified in the Contract Documents, the Contractor is free to utilize any methods or equipment that will accomplish the Project work in conformity with the requirements of the Contract Documents. When the methods or equipment anticipated or proposed for use by the Contractor are other than may be specified in the Contract Documents or are other than is standard practice in Connecticut, or when the Engineer may inquire as to the methods or equipment anticipated for use, the Contractor shall demonstrate to the satisfaction of the Engineer that the subject methods or equipment will accomplish the Project work in conformity with the Contract Documents by means including, but not limited to, providing references, documentation, and demonstrations. Should the Engineer deem that any method or equipment in use by the Contractor is not satisfactory, i.e. that it does not, or will not, result in work conforming with the Contract Documents, the Contractor shall cease using the subject method or equipment and shall propose an alternative to the Engineer's satisfaction.

Should the Contractor continue to use any method or equipment subsequent to being notified of the Engineer's deeming the same not satisfactory, any work resulting or affected thereby shall be considered unauthorized subject to all restrictions and limitations accorded unauthorized work by the Contract Documents.

In the event the Contractor fails to remove from the Project site any person or unsafe equipment as required by the Engineer, or fails to furnish suitable and/or sufficient personnel for the proper prosecution of the work, the Engineer may suspend the work by written notice until such orders are complied with.

8. **Subcontracting**

(a) In all matters relating to the Contract and enforcement of the provisions of the Contract Documents, with the exception of subarticles (c), (d), and (e) below, any subcontractors utilized to perform Contract work shall be considered employees of the Contractor; and their work shall be subject to the provisions of the Contract Documents as such. Any use of the term "subcontractor", or reference to subcontractors or subcontracting contained in the Contract Documents is strictly for convenience of the Owner and Contractor in distinguishing between regular employees of the Contractor and legal entities subcontracted by the Contractor to specifically perform work on this Project.

(b) In accordance with the preceding paragraph, the Contractor shall be responsible for the performance, finished products, acts and omissions of his subcontractors, and of persons either directly or indirectly employed thereby, in all respects in matters relating to the Contract and applicable provisions of the Contract Documents.

(c) Prior to execution of the Contract, the Contractor shall furnish the Engineer with a list of all subcontractors proposed to perform work on the Project, together with the extents of the work to be performed thereby. Accompanying the list, the Contractor shall include a statement of qualifications, including related experience and listing projects involving similar work successfully completed, for those subcontractors proposed to perform major categories of the Project Work. The Contractor may utilize the services of specialty Subcontractors on those portions of the work which, under normal contracting practices are performed by specialty subcontractors. The Contractor shall not award any portion of the work to a Subcontractor without prior written approval of the Owner or Engineering firm associated with this project. The acceptance of any and all Subcontractors shall reside with the Owner, and the Owner's decision shall be final. The Contractor shall be fully responsible to the Owner for the performance, finished products, acts, and omissions of his Subcontractors and persons directly or indirectly employed thereby.

The Contract shall cause appropriate provisions to be included in all subcontracts relative to this project to bind Subcontractors to the provisions of the Contract and these Bid Documents as applicable to work performed by the Subcontractor on this project; and appropriate provisions to give the Owner the same powers and authority over any Subcontractor as it has over the Contractor under the provisions of said documents.

(d) The Engineer has the authority to reject, for reason of insufficient experience, unsatisfactory past performance, or any other legitimate reason which may bring into question the proposed subcontractor's successful performance of the subject work, the use of any specific subcontractor to perform Project work; and the Contractor shall abide by the same. The Contractor shall provide the Engineer with any additional information requested to assist in the evaluation of the proposed subcontractors.

(e) The Contractor shall maintain said list of subcontractors up-to-date throughout the Project; and shall provide the Engineer with an updated copy in every instance that said list is revised. Any proposed changes to the list, following Contract execution, shall be submitted to and approved by the Engineer prior to any subcontractor not listed on the current active list held by the Engineer performing any Project work. The Engineer may require information as set forth in subarticles (c) and (d) above to assist in his evaluation of any additional subcontractors or duties proposed to be added to the list, and the Contractor shall supply the same.

(f) Nothing contained within the Contract Documents shall create, is intended to create, or should be construed to create a contractual relationship of any kind between the Owner and any subcontractor.

9. **Construction Surveying / Layout**

Unless otherwise designated in the Special Provisions, the Contractor is responsible for all construction surveying, staking, and layout as is necessary and/or is typically required for the prosecution of the work in accordance with the Contract drawings and specifications. The Engineer shall establish bench marks, base lines, and reference points as deemed necessary by the Engineer for the Contractor to meet this responsibility. The Contractor is liable for the protection of said bench marks, base lines, and reference points, as well as for any existing property corner markers located within the project site; and the Engineer shall reset or replace, at the Contractor's expense, any of the same that are removed, lost, destroyed, or in any way damaged or disturbed during the prosecution of the Project Work. The Contractor assumes full responsibility for the accuracy, relative to the provided bench marks, base lines, and reference points, for all dimensions and elevations measured and/or derived from the same; and it is the Contractor's responsibility to verify all such dimensions and elevations.

If so called for in the Special Provisions, the Contractor shall designate a Project Surveyor. The designation thereof, and the associated functions, duties, and responsibilities thereof, shall be in accordance with the provisions of the subject Article of the Special Provisions.

Except where separate bid items are included for all or portions of such work, all construction surveying and layout work shall be considered as included in, and incidental to, the prices bid for the various bid items in the Contract Documents.

10. **Permits and Regulations**

The Contractor shall procure and pay for all permits and licenses necessary for the execution of his work and the use of such work when completed.

The Contractor shall comply with all laws, ordinances, rules and regulations relating to the performance of the work, the protection of the adjacent property and the maintenance of passageways, guard fences or other protective facilities.

The Contractor shall, at his own expense, secure and pay to the appropriate departments (Board of Public Works, New Britain Water Department, Building Department) of the City of New Britain or State of Connecticut, the fees or charges for all permits for street excavations, pavements, sidewalks, curbs, sealing of house connection drains, pavement cuts, building, electrical, plumbing, water, subway (underground electric and telephone) and sanitary and storm water sewer permits required by the regulatory body of any of its agencies. The Contractor's attention is called to the fact that the City Engineer's office has a list of all State maintained streets which is readily available to the Contractor for inspection.

The Contractor shall comply with the applicable local laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or off the Project Area and commit no trespass on any public or private property in any operation due to or connected with the improvements embraced in this Contract.

11. Access Considerations

The Contractor shall conduct his work at all times and use all practical means available to minimize the interference to traffic, both vehicular and pedestrian, and the inconvenience and discomfort of adjacent residents and property owners and the general public. Except as otherwise provided for in the Special Provisions, vehicular access, as may be restricted by the prosecution of the Project work, will be maintained at all times to all adjacent or abutting properties, except when necessary construction precludes such access for reasonable periods of time. Pedestrian access shall be maintained to all adjacent or abutting properties at all times. Emergency access to all structures and emergency facilities shall be maintained at all times. In the event that Construction activities cause vehicular access to any property to be interrupted for more than, in the opinion of the Engineer, a reasonable time, the Contractor shall construct, or make other arrangements for, reasonably equivalent access to such property to the satisfaction of the Engineer.

In the maintenance and protection of traffic, the Contractor shall abide by, in order of preference and subject to all applicable laws, 1) the rules, regulations, and directions of the New Britain Police Department, 2) the applicable provisions of the most recent edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways", (MUTCD) and any supplements thereto, as published by the Federal Highway Administration of the U.S. Dept. of Transportation, 3) any directives of the Engineer, and 4) the applicable provisions of the Contract Documents.

The Contractor shall supply, maintain, and incorporate into the Project such barricades, warning lights, and directional, informational, warning, construction, and other signage, as well as any other safety precautions, as may be required, necessary, or prudent for the protection and safety of person, property, Project work and workers; and as may be required, necessary, or prudent to the maintenance of traffic flows and access in clear and convenient means (as is practical). The

Contractor is referred to said MUTCD regarding the proper selection, placement, and usage of many such devices and precautions.

The Contractor is hereby notified that the New Britain Police Department may require the presence of police officers for the purpose of safety and traffic control at any location where construction activities affect a public street and the flow of traffic thereon. The Contractor is responsible for 1) contacting the traffic division of the Police Department at 826-3000 to properly notify them of the pending construction to determine what level of police presence may be required and arranging for the same, and 2) paying all costs to the Police Department for the same. Unless the necessity for police presence was not contemplated in the Project at the time of Contract execution, or by any Change Order thereafter, and is the result of the Contractor's actions or inactions, the Contractor shall be appropriately reimbursed for all such costs by the Owner.

The Contractor shall cooperate with the various parties involved in the delivery of mail, school transportation, and the collection and removal of trash and recyclables to maintain existing schedules for these services.

If a bid item for "Maintenance and Protection of Traffic" and/or other related bid items are included in the Contract, all work required or performed, and the associated expenses incurred, in accordance with the provisions of this Article are considered to be included as a part of such bid items. If there are no such bid items, or if the project is bid lump sum, all work required or performed, and the associated expenses incurred, in accordance with the provisions of this Article are considered to be part of the project work as bid, and therefore are considered as included in the price bid for the various Bid items. The Contractor shall be due no additional compensation as a result of any work performed or expenses incurred in accordance with this Article.

12. Protection of Person and Property

The Contractor is responsible and liable for the protection and care of persons and property from harm or injury within the Project Site and otherwise related to his prosecution of the Project Work. The Contractor shall exercise proper precaution at all times for said protection and care of persons and property from harm or injury as a result of the Contractor's actions, or inactions, both on and off the Project site.

The Contractor shall at all times comply with the provisions of all applicable Federal, State, and local safety and health laws, codes, and regulations; and shall take such additional safety and health measures he may determine to be necessary for said protection and care, as well as any such measures that the Engineer may deem to be reasonably necessary.

At all times, as required by any applicable OSHA standards, regulations, instructions, and/ or other guidelines, the Contractor shall have at the site of any excavation, confined space, or any other aspect of the Project work regulated thereby, an employee or other authorized representative having the appropriate training, knowledge, and authority to be considered a "competent person"

regarding such work under said OSHA standards, regulations, instructions, and/or other guidelines.

The Contractor shall install and maintain such barricades, fences, and other protective and warning facilities and measures, and shall employ such methods and means, as may be appropriate, required, and/or directed, to protect person and property from excavations, equipment, stored materials, slopes, ditches, flowing water or sewage, exposed utilities, and/or other aspects of the work which may pose a hazard.

All applicable aspects of the Project shall be in accordance with the safety provisions of the "Manual of Accident Prevention in Construction" as published by the Associated General Contractors of America, to the extent said provisions are not in conflict with applicable laws or regulations. Said safety provisions are hereby made a part of this Article by reference.

To the extent possible, the Contractor shall plan the work in such a manner as to avoid the use of explosives in the close proximity structures or utilities. When the use of explosives is necessary for the prosecution of the work, the Contractor shall use the utmost care not to endanger person or property, and shall comply with the requirements of all applicable laws, codes, and regulations. The Contractor is responsible to notify all nearby property owners, the owners of nearby utilities, and all others who may be affected, of the Contractor's intention to use explosives on the project; and such notice shall be given sufficiently in advance of the use of the explosives as to allow the noticees and the Contractor to take any actions deemed necessary for protection of person and property. Such notice shall not relieve the Contractor from responsibility for any damage and/or claims resulting from blasting operations.
The Contractor shall be held responsible for, and required to make restitution at his own expense for, any and all damage to person or property resulting from any act, omission, carelessness, or neglect on the part of the Contractor, or the agent or employees thereof, during the prosecution of the work, or lack thereof, and until its final acceptance.

The Contractor shall maintain an accurate record of all cases of death, occupational disease, and/or injury requiring medical attention or causing loss of time from work, and/or all cases of property damage, occurring as a result of or in the course of the prosecution of work under this Contract. The Contractor shall promptly furnish the Engineer with reports concerning these matters.

The Contractor and his actions shall also be subject to the provisions of Section 1.07.09 of the Reference Specification "Form 816"; and said Section 1.07.09 is hereby made a part of this Article by reference.

All work performed or required, and the associated expenses incurred, in accordance with the provisions of this Article are considered part of the project work as bid, and therefore are considered as included in the price bid for the various Bid items. The Contractor shall be due no additional compensation as a result of such work performed or expenses incurred.

13. Subsurface Conditions

The Contractor is responsible for performing whatever research and/or investigations deemed appropriate for determining the existing soil, groundwater, or other subsurface conditions which may have bearing on the Project work prior to submitting a bid on the Project (reference Article 10 of the Instructions to Bidders). Any information regarding borings, test pits, or other soils or subsurface conditions included in the Contract Documents is provided solely as a courtesy to be used as seen fit by the Contractor; and does not in any way relieve the Contractor of any responsibilities stated in the Contract Documents. The Contractor will not be granted any additional compensation, or any other extra, for any additional work or costs associated with subsurface conditions which could have been reasonably expected to exist and/or to interfere with, or otherwise affect, the Project work in any way.

14. Existing Conditions Found Different

In addition to showing the construction proposed under this Project, the drawings show certain information obtained by the Owner regarding conditions and features which exist at the site of the work, both at and below the surface of the ground.
The Owner and the Engineer expressly disclaim any responsibility for the accuracy or completeness of the information given on the drawings with regard to the existing conditions and features and the Contractor will not be entitled any extra compensation on account of inaccuracy or incompleteness of such information except as provided herein. It is specifically called to the Contractor's attention that all services, laterals, etc., are not shown on the Contract Drawings and it shall be his responsibility to locate and protect the same. The information which is shown is only for the convenience of the Contractor, who must verify this information to his own satisfaction.
The giving of this information upon the Contract Drawings will not relieve the Contractor of his obligations to support and protect all existing utilities, structures and fixtures, which may be encountered during the construction of the work and to repair any and all damages done to such existing utilities.

The Contractor shall immediately notify the Engineer of any existing or latent conditions encountered during the prosecution of Project work which are significantly different from those shown or described in the Contract Documents or from those expected by the Contractor, and/or which may affect or alter the Project work in any way contrary to the Plans and Specifications; and shall, upon such encounter, immediately suspend all work relating to, or affected or altered by, said different conditions.

The Engineer shall thereupon promptly investigate said conditions and, if the conditions are found to be substantially different, shall give such advice and/or instructions, and shall make such adjustments and/or alterations to the Drawings, Specifications, proposed work, quantities, and/or compensation due to the Contractor, as deemed appropriate and/or necessary, and in a manner consistent with the applicable provisions of the Contract Documents. The Contractor shall not

resume the performance of any work suspended in accordance with the provisions of this Article until being instructed to do so by the Engineer.

Any work associated with existing conditions found different which is performed by the Contractor and which is, in the opinion of the Engineer, in non-compliance with the provisions of this Article shall be considered unauthorized. Any such unauthorized work shall not be considered to be extra work nor shall any additional compensation be due the Contractor therefor, except as otherwise determined by, and at the sole discretion of, the Engineer.

15. **Existing Underground Utilities - Protection and Responsibilities**

The Contractor must notify Call Before You Dig (Tel. 1-800-922-4455) in accordance with Public Act No. 81-146 & 77-350 at least forty-eight (48) hours prior to start of construction, and shall keep such notification properly updated as the prosecution of the Project work proceeds.

The Contractor should inquire of the Water Department of the City, Southern New England Telephone Company, Northeast Utilities (Helco & C.L.&P), Connecticut Natural Gas Corporation, Farmington River Power Company, United Cable T.V. and the City Public Works Department and any other public utility companies as to the locations of their facilities, particularly house service pipes, in the vicinity of his trenches and mark or cause to have marked on the site the locations of such pipes, etc. For the guidance of his employees and so that damage to such pipes may be avoided. The Contractor shall protect water pipes from freezing at all times during cold weather.

The Contractor prior to opening an excavation shall make every effort to determine whether underground installation, i.e., sewer, water, fuel, electric lines, etc., will be encountered and if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined by careful probing or hand digging, and when it is uncovered, proper supports shall be provided for the existing installation. The Contractor shall, without expense to the City, do everything necessary to provide proper support, protect and maintain from direct or indirect injury all utilities, pipes, bridges, conduits, sewers, drains, wires, poles, or fixtures of all kinds lawfully in the line of excavation or adjacent thereto, and all fences, walls, buildings or other structures and property in the vicinity which may be damaged by the work herein contemplated. He shall give at least 24 hours notice, before breaking ground, to the owners of the structures, pipes or wire conduit that may be affected by his operations and shall not cause any hindrance to or interference with any such owners or their agents in protecting or repairing their property should they wish to do so, but will suffer them to take all such measures as they may deem necessary for said purpose.

The Contractor shall be responsible for the repair of or the replacement of any underground utilities, laterals or mains broken or damaged and any costs for maintenance service while line is out of service along the course of construction. Omissions or improperly located utility lines on the contract drawings will not be cause to hold the Owner liable.

The Engineer may require the Contractor to take proper steps to protect the main lines of public utilities in the immediate vicinity of the work when endangered by the operation of the Contractor, and, if the Contractor fails to take adequate provisions to protect such lines or structures the Engineer may employ others to perform protective work, as may be reasonably needed, at the Contractor's expense.

Guard rails, posts, guard cables, signs, poles, markers, mail boxes, fences, wall and stone walls, etc., which are temporarily removed to facilitate construction, shall be replaced and restored in their original condition to the satisfaction of the Owner or Engineer.

16. **Sanitary Provisions**

The Contractor shall provide an approved field toilet to maintain a neat and sanitary condition on the job site. The Contractor shall commit no public nuisance. These facilities shall be cleaned regularly and in all ways comply with the State and City Health Regulations. The Contractor shall provide a safe drinking water supply for use of all working personnel on the work site including the construction inspector.

17. **Overtime by City Employees**

In addition to any license or permit fees that may be required by the ordinances of the City of New Britain or by the rules or regulations of any department thereof, any person, firm or corporation or combination of them, who shall perform any work on any Saturday, Sunday, legal holiday or any other day when City departments are not working or who shall perform any work on any day at such times as to necessitate the employment of City personnel outside the hours of the normal eight (8) hour working shift for the assigned employee(s) in any day or forty (40) hours per week, shall pay to the City of New Britain or the proper department thereof any extra costs of inspection, supervision or employment of City personnel incurred by said City of New Britain or any department thereof.

The City of New Britain's recognized paid holidays are as follows: New Year's Day, Martin Luther King, Jr. Day, Lincoln's Birthday, Washington's Birthday, Good Friday, Memorial Day, Independence Day. Labor Day, Columbus Day, Veterans' Day, Thanksgiving Day, the day following Thanksgiving, Christmas Day and any holiday officially proclaimed as such by the Congress of the United States or the Legislature of the State of Connecticut. Holidays falling on a Saturday will be celebrated on the preceding Friday, holidays falling on a Sunday will be celebrated on the following Monday.

18. **Night Work and Sundays**

Night work or work on Saturdays, Sundays or legal holidays requiring the presence of an inspector will be permissible upon the approval of the Engineer except in emergencies. Should night work be permitted, required or desired to operate continuous night work or for emergency night work, the lighting, safety and other facilities which are deemed necessary for performing such night work

shall be provided by the Contractor and comply with the applicable safety codes. Night work, work on Saturdays, Sundays or legal holidays, if performed, the Contractor shall receive no extra payment, but compensation shall be considered as having been included in the prices stipulated for the appropriate items of work as listed in the bid.

19. **Record Drawings**

Unless otherwise designated in the Special Provisions, the Contractor shall be responsible for preparing various record drawings for the City's files. These drawings shall be executed in the manner specified in the edition of the "City of New Britain, Bureau of Engineering, Requirements for As-Built Maps" current at the time this Contract was entered into. Typical maps and copies of the current standards are available for review and purchase at the Bureau of Engineering.

20. **Sewage and Water Flows Encountered**

The Contractor shall furnish all equipment and take all precautions and steps necessary and appropriate for conveying and perpetuating, in their entirety, all sanitary sewage, storm, groundwater, surface water, and flood water flows encountered in the prosecution of the Project Work in a safe, sanitary, and non-degrading manner. Such work includes, if necessary and appropriate, but is not limited to, furnishing, installing, and operating pumps and conduits, constructing coffer dams, diversion channels, and sumps, the blocking of conduits, and other means and methods used for such purposes.

Sanitary sewage flows shall be conveyed in a closed conduit and shall only be discharged into the City's sanitary sewer system. Under no circumstances shall the contractor willfully allow sewage flows to discharge to the storm drainage system, surface drainways, or any surface water.

Water discharged to the storm drainage system, any surface drainway, or any surface water shall be in accordance with the regulations and standards of the Connecticut Department of Environmental Protection and/or any other regulating authority. In addition, the discharge of water onto private property is only allowed with the prior written permission of the subject property owner and the Engineer.

All aspects of handling sewage and water encountered during prosecution of the Project work is subject to the supervision and approval of the Engineer. Any approval or intervention of the Engineer in such matters in no way relieves the Contractor of any of his responsibilities to comply with any and all applicable laws, regulations, permits, orders, and/or directives established or given by a regulating authority, and/or the safe perpetuation of any such flows.

The Contractor is responsible for knowledge of and compliance with all aspects of any laws, regulations, permits, orders, and/or directives established or given by a regulating authority relating to the handling of sewage and water flows associated with the Project. The Contractor is responsible for obtaining all approvals, and for performing all sampling, testing, and/or analyses, which may be required by the same.

The Contractor is also responsible for any damages to any facilities or properties as a result of his efforts to handle sewage and water encountered, and for the complete restoration of the same upon the completion of any measures which affected the facility or property.

Except where a separate bid item (or items) is included in the Contract Documents for such work, all work and other aspects of handling water and sewage flows shall be considered as included in, and incidental to, the prices bid for the various bid items in the Contract Documents. The Contractor will not be granted any additional compensation, or any other extra, for any work or other aspect of handling water and sewage flows which could have been reasonably expected to be required or necessary in the prosecution of the Contract Work, or which is a result of the Contractor's actions, lack of action, negligence, or failure to comply with any aspect of this Article, or any other provision of the Contract Documents.

21. Pollution Control

The Contractor shall conduct his operations in conformity with all applicable permits, regulations, and standards of the Connecticut Department of Environmental Protection, and any other Federal, State, or local agency or authority having jurisdiction thereover, concerning water, air, and noise pollution and the handling and disposal of toxic or hazardous materials.

Pollution control measures shall apply to all contractor activities including, but not limited to, the construction site, waste and disposal areas, borrow sites and gravel banks, storage areas, haul roads, access roads, and detours.

In case of the failure on the part of the Contractor to perform pollution control work in a timely manner, the Engineer may, upon 48 hours' written notice, arrange for the performance of the subject work by approved forces, and the cost thereof will be deducted from any monies due, or which may become due, the Contractor under the Contract. In the case of an emergency the Engineer may take such actions immediately upon what he considers to be failure of the Contractor to perform pollution control work in a timely fashion.

(a) Water Pollution Control Measures - The Contractor shall exercise every reasonable precaution throughout the life of the contract to prevent, control and abate siltation, sedimentation and pollution of all surface waters, underground water systems and inland wetlands. The City of New Britain will obtain all permits which may be required concerning inland wetlands and watercourses for work appearing on the plans. The Contractor shall obtain any permits and pay any fees required for work not included on the plans in the fulfillment of his contract concerning the removal of material, depositing of material in, obstruction of, construction within, altering or polluting of any inland wetland, tidal wetland, coastal or navigable water, streams, ponds, lakes, water supplies or other water bodies.
Construction operations in water areas shall be held to a practicable minimum and shall be restricted to those areas which must be entered for the planned construction and for temporary operations pursuant thereto. The frequent fording of live streams shall be avoided during the construction and the use of temporary bridges or culverts is preferred. Mechanized equipment

shall not be operated promiscuously in live streams. Roiling of waters shall be cause for the construction of diversion dikes or settling basins to avoid sediment problems.

The banks and beds of waterways and impoundments shall be properly cleared of all debris, falsework and obstructions placed therein or caused by the construction operations, but which are not a part of the planned improvement.

The dumping of oil or other deleterious materials on the ground is expressly forbidden. The Contractor shall provide a means of catching and retaining drained oil, removed oil filters, or other deleterious materials and of properly disposing of same, subject to the approval of the Engineer.

(b) Air Pollution Control Measures - The Contractor shall exercise every reasonable precaution throughout the life of the contract to safeguard the air resources of the State by Controlling or abating air pollution as set forth by the Department of Environmental Protection's regulations. These measures shall include the control and abatement of dust, fumes, mist, smoke, vapor, gas, aerosol, other particulate matter, odorous substances or any combination thereof arising from the construction operations, hauling, storage or manufacture of materials. All trucks carrying materials susceptible to having pollutants enter the ambient air are to be covered during transit.

(c.) Noise Pollution Control Measures - The Contractor shall take measures to control the noise intensity to comply with the prescribed ratings as set forth by the regulations of the Department of Environmental Protection, the Occupational Safety and Health Administration and any other agency of the State or Federal government.

(d) Erosion and Sedimentation Control Measures - All watercourses shall be protected from sedimentation, both during and after construction. This provision applies particularly to dewatering activities, storage of excavated or stockpiled material, trench excavation, and placement of compacted berms and embankments. The Contractor shall control erosion and sedimentation in accordance with the publication entitled "Guidelines for Soil Erosion & Sediment Control" issued by the Connecticut Council on Soil and Water Conservation, January 1985, or as otherwise approved by the Engineer. Provisions shall include, but not be limited to, haybale check dams across any outlet channels and at the toe of all embankments under construction, and temporary culverts at all stream crossings, such that water which flows downstream does not contain additional sediments due to the Project work. The Contractor shall submit details of his erosion and sediment controls to the Engineer for review.

(e) Cleaning of Adjacent Streets - The Contractor shall sweep, and use other methods as necessary, to keep adjacent streets clean of mud, dirt, and debris caused by Project activities. Such sweeping or other methods shall be used on a daily basis when mud, dirt, or debris has been deposited on a street.

The Contractor is responsible for knowledge of and compliance with all aspects of any laws, regulations, permits, orders, and/or directives established or given by a regulating authority

relating to pollution control associated with the Project. The Contractor is responsible for obtaining all approvals, and for performing all sampling, testing, and/or analyses, which may be required by the same.

Except where a separate bid item (or items) is included in the Contract Documents for such work, all work and other aspects of pollution control shall be considered as included in, and incidental to, the prices bid for the various bid items in the Contract Documents. The Contractor will not be granted any additional compensation, or any other extra, for any work or other aspect of handling water and sewage flows which could have been reasonably expected to be required or necessary in the prosecution of the Contract Work, or which is a result of the Contractor's actions, lack of action, negligence, or failure to comply with any aspect of this Article, or any other provision of the Contract Documents.

22. Contaminated or Hazardous Material

In the event the Contractor, during the prosecution of Contract Work, encounters any material that is believed to be contaminated, toxic, or hazardous to person or the environment, provided that the occurrence of, handling of, and protection of and from the subject material was not contemplated at the time of Contract execution, the Contractor shall immediately cease work in the immediate area and notify the Engineer. If the nature of the material or the situation under which it is encountered is such that immediate notification of the Connecticut Dept. of Environmental Protection or other regulating agency, is required, such notification is the responsibility of the Contractor.

Upon said notification of the Engineer by the Contractor, the Engineer shall take the steps deemed necessary for making investigations and determinations regarding the handling of, protection of and from, and/or the disposal of the subject material. The Engineer shall delineate, or have delineated, a "no-work" area in the vicinity of the subject material within which all project work shall remain suspended until written permission to the contrary is given by the Engineer. The Contractor shall follow all directions and recommendations of the Department of Environmental Protection, or any other regulating authority having jurisdiction, and shall comply with all applicable laws and regulations, regarding the handling of, protection of and from, and/or disposal of the subject material. The Contractor shall also cooperate fully with any special personnel whom the Owner may retain the services of for the same.

23. Connection to Existing Work

The Contractor shall remove such existing masonry, concrete, equipment and piping as is necessary, in order to make the proper connections to the existing work at the locations shown. Also, he shall make the necessary pipe line, roadway and other connections required, in order that on completion of the Contract, water, sewage, or storm water, or as the case may be, will flow through the pipe lines and structures. No extra payment will be made for this work, but the entire cost shall be included in the unit or lump sum prices bid for the various items of the work to be done under this Contract.

24. Snow Removal

If the Contractor's operations or occupancy of any public street or highway, or the rough surfaces over any trench or area being maintained by the Contractor, shall interfere with the removal or plowing of snow or ice by the public authorities or property owners, or sanding of icy surfaces, in the ordinary manner with regular highway equipment, then the Contractor shall perform such services for the public authority or property owner without charge; or failing to do so, shall reimburse the said authority, owners or the City for any additional cost they incur for doing such work occasioned by the conditions arising from the Contractor's operations, occupancy or trench surfaces, together with the damage to the equipment of said parties by those conditions, or claims of any party for damage or injury or loss by reason of failure to remove snow or ice, or to sand the icy spots under those conditions.

25. Inclement and Freezing Weather Conditions

In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer shall direct, the Contractor will, and will cause the Subcontractor to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or materials have been damaged by the failure of the Contractor or Subcontractors to protect the work, such work or materials shall be removed and replaced at the expense of the Contractor.

Unless written permission is given, work liable to be affected by frost or freezing shall be suspended during freezing weather when work proceeds under freezing conditions the Contractor shall provide approved facilities for heating the materials and for protecting the finished work.

26. Final Inspection and Certificate of Completion

Upon the completion of all work whatsoever required, the Contractor must submit a written request to the City Engineer for a final inspection. The Engineer and/or his representative, representatives of the governing authority of the completed project (re: Public Works, Water Dept., etc.) and the Contractor shall hold a semi-final inspection of all work to ascertain that the work is acceptable to the governing authority.

Unacceptable work shall be corrected at no additional costs. After approval, the Engineer shall file a written certificate with the Owner and with the Contractor as to the entire amount of work performed and compensation earned by the Contractor including extra work and compensation thereof.

27. Payment to Contractor

The Owner agrees to pay the Contractor monthly or as nearly once a month as possible, ninety-five (95%) percent of the whole amount due the Contractor for the amount of work which the

Engineer shall estimate as done up to the last day of that particular month. Payment of the estimated bill shall follow within thirty days after the receipt and approval of the estimate. It shall also be required in this Contract that the weekly payrolls and basic records (reference General Conditions paragraph 53) be submitted at the same time with the estimated monthly bill.

28. **Change Order Limitation**

Pursuant to Section 2-567 of the Code of Ordinances of the City of New Britain, no change order shall be approved without competitive bidding, unless it is within the scope of work of the original project and the total amount of such change order does not exceed ten percent **(10%)** of the original price.

29. **Final Payment and Liens**

Thirty (30) days after the filing of such certificate of completion, the Owner shall pay to the Contractor 95 percent of the amount therein stated, less all prior payments and advances whatsoever to or for the account of the Contractor. All prior estimates and payments, including those relating to extra work shall be subject to correction by this payment which is throughout this Contract called Final Payment. The final 5% of the total amount will be paid at the end of one year (12 months) maintenance period, provided the whole of the work is at that time in conformity with the requirements of the Contract; if not, then as soon thereafter as the work shall be made to conform thereto. Said maintenance period for all parts of the work shall not commence prior to filing of the certificate of completion. After final acceptance of the work, the Contractor may request the filing a maintenance bond covering the maintenance period for the total amount of the retained 5% percent. If the City approves the maintenance bond option, the retained 5% percent shall then be paid to the Contractor.

Neither the final Contract payment nor any part of the retainage thereto shall become due to the Contractor until he has, if required, delivered to the Owner either a complete release of all liens arising out of the Contract or receipts in full in lieu thereof. In addition, if required, the Contractor shall furnish the Owner an affidavit that states that so far as he has knowledge or information, the releases and receipts described above include all labor, material and equipment for which a lien could be filed. In the event a subcontractor or materials provider is unwilling or unable to furnish a release or receipt in full, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against any liens. If any liens remain unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a lien, including all costs and a reasonable attorney fee.

30. **Disputes**

A. All disputes arising under this contract or its interpretation, whether involving law or fact or both, or extra work, and all claims for alleged breach of contract shall within ten (10) days of commencement of the dispute be presented by the Contractor to the Owner for decision. All papers pertaining to the claims shall be filed in quadruplicate. Such notice need not detail the

amount of the claim, but shall state the facts surrounding the claim in sufficient detail to identify the claim, together with its character and scope. In the meantime the Contractor shall proceed with the work as directed. Any claim not presented within the time limit specified within this paragraph shall be deemed to have been waived, except that if the claim is of a continuing character and notice of the claim is not given within ten days of its commencement, the claim will be considered only for a period commencing ten days prior to the receipt of the Owner of notice thereof.

B. The Contractor shall submit in detail his claim and proof thereof. Each decision by the Owner will be in writing and will be mailed to the Contractor by registered mail, return receipt requested.

C. If the Contractor does not agree with any decision of the Owner, he shall in no case allow the dispute to delay the work but shall notify the Owner promptly that he is proceeding with the work under protest and he may then except the matter in question from the final release.

31. Arbitration and Litigation

Any controversy or claim arising out of or relating to this contract, or the breach thereof, shall, at the option of the Owner, be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association and judgment upon the award rendered by the Arbitrator(s) may be entered in any court having jurisdiction thereof. The Owner shall exercise its option to arbitrate concurrent with the rendering of its final decision on the claim. Should it fail to render a final decision within the prescribed time or fail to exercise its option, the claim will be determined in accordance with the Rules of the American Arbitration Association as hereinbefore stated.

32. Purchase Assignment

The contractor or subcontractor offers and agrees to assign to the public purchasing body all right, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act, 15 U.S.C. Section 15, or under Chapter 624 of the General Statutes of Connecticut, arising out of the purchase of services, property or intangibles of any kind pursuant to a public purchase contract or subcontract. This assignment shall be made and become effective at the time the public purchasing body awards or accepts such contract, without further acknowledgment by the parties.

33. Quality of Materials

All work done and materials furnished shall be new and of the best quality customarily used in or furnished for installation of the character of that proposed. Many features of the proposed work are described in detail herein, but the failure to describe any part of the proposed work or any detail or appurtenance thereof shall not be an exception to the above rule. The absence of requirements in the contract or specifications covering details usually included in first-class installation of this type shall not excuse the Contractor for their omission in this work.

34. Defective Materials

The Engineer may reject any or all defective or damaged material or any material not, in his opinion, in conformity with the specifications. Material which may at any time be rejected shall be promptly removed from the site. If the Contractor does not remove defective material promptly after written notice, the Engineer may cause such removal by such means as he shall select and at the Contractor's expense. No defective or damaged materials shall be used in the work. All defective material shall be conspicuously marked.

35. Uncovering and Corrective Work

If any portion of the work should be covered contrary to the request of the Engineer or to requirements specifically expressed in the Contract Documents, it must, if required in writing by the Engineer, be uncovered for his observation, and the Contractor shall bear the costs of uncovering and recovering and shall be responsible for resulting delays, even if the uncovered work is found to be in accordance with the Contract Documents.

The Contractor shall promptly correct all work rejected by the Engineer as defective or as failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all cost of correcting such rejected work, including compensation for the Engineer's additional services made necessary thereby.

If the Contractor fails to correct any such defective or nonconforming work to the satisfaction of the Engineer within a reasonable time after notification of the same, the Owner may, upon written notification to the Contractor of his intent to do so, separately arrange for the work to be corrected as he deems fit; and deduct any costs associated with the arrangements for and performance of the corrective work from any monies due, or to become due, the Contractor. Should such costs exceed the monies due, or to become due, the Contractor, than the Contractor shall be liable to the Owner for all amounts exceeding those due, or to become due, the Contractor.

36. Protection of the Work

The Contractor shall protect all work done under this contract and all work done by other contractors within the limits of this contract during the progress of the work and until completion and acceptance, from injury by reason of any work under this contract or by reason of any negligence on his part, or by reason of weather conditions.

37. Clean-up

Upon suspension or completion of the work or of any section thereof, the Contractor shall remove all materials, equipment and rubbish and shall leave the premises in a neat and orderly condition.

The premises shall, during the progress of the work, be kept clean, presentable and satisfactory to the Engineer, and shall be left so at the completion of the contract.

38. Work Stoppages

Should the City be prevented or enjoined from proceeding with work either before or after the start of construction by reason of any litigation or other reason beyond the control of the City, the Contractor shall not be entitled to or assert claim for damage by reason of said delay. However, time for completion of the work will be extended to such reasonable time as the City may determine by means of a written Change Order.

39. Sheeting, Shoring and Bracing

Where necessary, the sides of trenches and excavations shall be supported by adequate sheeting, shoring, and bracing. The Contractor shall be held accountable and responsible for the sufficiency of all sheeting, shoring, and bracing used and for all damage to persons, property, streets or utilities resulting from the improper quality, strength, placing, maintaining, or removing of the same. Where sheeting is removed, care shall be taken not to disturb the new work or existing utilities and structures.

No sheeting is to be left in place unless expressly permitted by the Engineer. No direct payment will be made for sheeting, shoring, and bracing, and compensation for such work and all expenses incidental thereto shall be considered as included in the unit prices bid for the various items of this contract.

40. Compliance with Law

A. In the administration and execution of the Project, the Applicant shall comply with all pertinent provisions of local, State and Federal law, and failure to do so shall constitute a default by the Applicant under this Agreement.

B. The contract is subject to the provisions of Section 4-114a(a)-(e) of the Connecticut General Statutes which state: "The contractor agrees and warrants that in the performance of this contract he will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, retardation or physical disability, including, but not limited to, blindness, unless it is shown by such contractor that such disability prevents performance of the work involved, in any manner prohibited by the laws of the United States or of the State of Connecticut. If the contract is for a public works project, the contractor agrees and warrants that he will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on such project. The contractor further agrees to provide the Commission on Human Rights and Opportunities with such information requested by the commission concerning the employment practices and procedures of the contractor as relate to the provisions of this section and Section 46a-56."

C. This contract is subject to the provisions of Executive Order No. Three of Governor Thomas J. Meskill promulgated June 16, 1971 and, as such, this contract may be canceled, terminated or suspended by the State Labor Commissioner for violation or of noncompliance with said Executive Order No. Three, or any State or Federal Law concerning nondiscrimination, notwithstanding that the Labor Commissioner is not a party to this contract. The parties to this contract, as part of the consideration hereof, agree that said Executive Order No. Three is incorporated herein by reference and made a part hereof. The parties agree to abide by said Executive Order and agree that the State Labor Commissioner shall have continuing jurisdiction in respect to contract performance in regard to nondiscrimination, until the contract is completed or terminated prior to completion. The contractor agrees as part consideration hereof, that this contract is subject to the guidelines and rules issued by the State Labor Commissioner to implement Executive Order No. Three and that he will not discriminate in his employment practices or policies, will file all reports as required, and will fully cooperate with the State of Connecticut and the State Labor Commissioner.

D. This contract is subject to the provisions of Executive Order No. Seventeen of Governor Thomas J. Meskill promulgated February 15, 1973, and as such, this contract may be canceled, terminated or suspended by the Contracting agency or the State Labor Commissioner for violation of or noncompliance with said Executive Order No. Seventeen, notwithstanding that the Labor Commissioner may not be a part to this contract. The parties to this contract, as part of the consideration hereof, agree that the Executive Order No. Seventeen is incorporated herein by reference and made a part hereof. The parties agree to abide by said Executive Order and agree that the contracting agency and the State Labor Commissioner shall have joint and several continuing jurisdiction in respect to contract performance in regard to listing all employment openings with the Connecticut Employment Service.

41. Termination for Convenience of the City

(a) The City may terminate performance of work under this contract in whole, or, from time to time, in part, if the City determines that termination is in its best interest. The City shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination, and except as otherwise directed by the City, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under his clause:

(1) Stop work as specified in the notice.

(2) Place no further subcontracts or orders for materials, services, or facilities related to the terminated work.
(3) Terminate all subcontracts to the extent they relate to the work terminated.
(4) Assign to the City, as directed by the City, all right, tittle, and interest of the Contractor under the subcontracts terminated, in which case the City shall have the right to settle or pay any termination settlement proposal arising out of those terminations.
(5) With approval or ratification to the extent required by the City, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for the purposes of this clause.
(6) As directed by the City, transfer title and deliver to the City (I) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the City.
(7) Complete performance of the work not terminated.
(8) Take any action that may be necessary, or that the City may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the City has or may acquire an interest.
(9) Use its best efforts to sell, as directed or authorized by the City, any property of the types referred to in subparagraph (6) above; provided, however, that the Contractor (I) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the City. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the City under this contract, credited to the price or cost of the work, or paid in any other manner as directed by the City.

(c) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the City a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the City. The Contractor may request the City to remove those items or enter into an agreement for their storage. Within fifteen days, the City will accept title to those items and remove them or enter into a storage agreement. The City may verify the list upon removal of the items, or if stored, within 45 days of the submission of the list, and shall correct the list, as necessary, before final settlement.

(d) After termination, the Contractor shall submit a final termination settlement proposal to the City in the form and with the certification prescribed by the City. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the City upon written request of the Contractor within this 1 year period. However, if the City determines

that the facts justify it, a termination settlement proposal may be received and acted upon after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the City may determine, based on the information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.

(e) Subject to paragraph (d) above, the Contractor and the City may agree upon the whole or any part of the amount to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (e) or (f) below, exclusive of costs shown in subparagraph (f)(3), may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be amended and the Contractor paid the agreed amount. Paragraph (f) below shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(f) If the Contractor and the City fail to agree on the whole amount to be paid because of the termination of work, the City shall pay the Contractor the amounts determined by the City as follows, but without duplication of any amounts agreed on under paragraph (e) above:

(1) The contract price for completed supplies or services accepted by the City (or sold or acquired under subparagraph (b)(9) above) not previously paid for, adjusted for any saving of freight and other charges.

(2) The total of-

(I) The costs incurred in the performance of the work terminated, including initial cost and preparatory expense allocable thereto. but excluding any costs attributable to supplies or services paid or to be paid under subparagraph (f)(1) above;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (I) above; and

(iii) A sum, as profit on subdivision (I) above, determined by the City under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the City shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(3) The reasonable costs of settlement of the work terminated, including-

(I) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of the termination settlement proposals and supporting data;
(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and
(iii) Storage transportation and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(g) Except for normal spoilage, and except to the extent that the City expressly assumed the risk of loss, the City shall exclude from the amounts payable to the Contractor under paragraph (f) above, the fair value, as determined by the City, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the City or to a buyer.

(h) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of the contract, shall govern all costs claimed or agreed to under this clause.

(I) The Contractor shall have the right of appeal, under the Disputes clause, for any determination made by the City under paragraph (d), (f), or (k), except that if the Contractor failed to submit the termination settlement proposal within the time provided in paragraph)d) or (k), and failed to request a time extension, there is no right of appeal. If the City has made a determination of the amount due under paragraph (d), (f), or (k), the City shall pay the Contractor (1) the amount determined by the City if there is no right of appeal or if no timely appeal has been taken, or (2) the amount finally determined on an appeal.

(j) In arriving at the amount due the Contractor hereby , there shall be deducted:

(1) All unliquidated advanced or other payments to The Contractor under the terminated portion of this contract;

(2) Any claim which the City has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the City.

(k) If the termination is partial, the Contractor may file a proposal with the City for an equitable adjustment of the price(s) of the continued portion of the contract. The City shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the City.

(l)

(1) The City may, under the terms and conditions it prescribes, make partial payments and payments against incurred by the Contractor for terminated portions of the contract, if the City believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the City upon demand, computed with interest at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination proposal because of a retention or other disposition of termination inventory until 10 days after the date of retention or disposition, or a later date determined by the City because of the circumstances.

(m) Unless otherwise provided for in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this Contractor three years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the City, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the City, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Use of premises.
4. Owner's occupancy requirements.
5. Work restrictions.
6. Specification formats and conventions.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Park and Aquatic Facility Renovations at AW Stanley Park, 2100 Stanley Street, New Britain, CT.

B. Owner: City of New Britain

C. Architect: TLB Architecture, 92 West Main Street, Chester, CT 06412

D. Geotechnical Engineer: GNCB Consulting Engineers, Inc., 130 Elm Street, Old Saybrook, CT 06475

E. Structural Engineer: GNCB Consulting Engineers, Inc., 130 Elm Street, Old Saybrook, CT 06475

F. Mechanical, Electrical and Plumbing Engineer: Innovative Engineering Services, LLC; 33 North Plains Industrial Road, Wallingford, CT 06492

G. Civil Engineer: Nathan L. Jacobson & Associates, Inc.; 86 Main Street, P.O. Box 337; Chester, CT 06412

H. Landscape Architect: Richter & Cegan, Inc.; Avon Park North, Box 567, 8B Canal Court; Avon, CT 06001

I. The Work consists of the following:

The City of New Britain wishes to undertake a replacement of the swimming pool facility located within AW Stanley Park, as well as other improvements for active and passive recreation. Generally, work consists of the following:

Aquatic Facilities:

The existing swimming pool and bathhouse shall be removed. The proposed facility will replace the pool with a new swimming pool, which includes a variety of water depths ranging from a zero-depth "beach" type entry to a eleven and a half foot deep diving well, with two, one-meter diving boards. The new facility, inclusive of pool and decks shall be constructed in a different area of the site than the current pool. A new utility building will also be constructed for pool equipment and parks maintenance.

Site work includes the regrading as necessary to provide open fields, a little league baseball diamond, basketball courts and improved parking and vehicular drives. Pedestrian walkways, landscaping and playground improvements are also planned. Site utilities and drainage, as required to support the planned development is included in the Work.

1.4 TYPE OF CONTRACT

A. Project will be awarded as a single prime contract.

1.5 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Work will be performed within an occupied City Park. Limit use of premises to areas within the Contract limits indicated. Work indicated to be completed outside the Contract Limit Line shall be coordinated with Owner's on-site activities and shall be included within the Contract Sum. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine constructions operations to area indicated on Drawings as the Contract Limit, except where noted to perform work outside the Contract Limits.
2. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public beyond the Contract Limit Lines.
3. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

4. Work will be performed in and adjacent to regulated wetland areas. No vehicles or materials may be parked or stored in these areas, and disturbance within these areas shall be limited to the Work indicated. Any disturbance shall be restored, a directed by the City.

C. Use of Existing Building and Pool: Maintain existing building and pool in a serviceable condition until such time as demolition is planned. The intent is to have the renovations and new construction completed for the 2017 swim season. However, if weather conditions or other factors warrant an extension of time, the existing pool facility must be operable for the 2017 swim season, as the loss of the aquatic programming will not be allowed. Should the existing pool be reused in 2017, necessary provisions for safe public access and egress will be required.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy adjacent portions of the site including all areas outside of the Contract Limit Line. Associated parking areas for those activities, outside the Contract Limit Line, shall be not be disturbed, or used by the Contractor. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain circulation paths around the site.

1. Provide not less than seventy-two (72) hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building or site, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

C. Substantial Completion shall be achieved as specified in the Draft Agreement.

1.7 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be performed during the time restrictions as set forth in the Instructions to Bidders.

B. Do not proceed with utility interruptions without Owner's written permission.

C. The Contractor shall be responsible for all permits and fees required by the State of Connecticut, Department of Health (DOH). Building Permit Fees shall be waived, with the exception of the State mandated DEEP fee, collected by the City when the permit is applied for.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.
2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include materials and equipment provided by the Owner through vendors with City of New Britain Contracts. The Contractor shall provide materials, systems and assemblies as specified and detailed as part of the Base Bid, in preparation for installation by Contractors selected by the Owner and assigned to the Contractor.

B. The Contractor shall sub-contract with the following vendors:

1. Red Hawk Fire and Security, 55 Robinson Boulevard, Orange, CT 06477 for security cameras and DVR system. Contact: Larry Amarucci. 800-528-3059.
2. RA Miller, 1193 Sawgrass Corporte Parkway; Sunrise, Florida 33323, for the Thorguard Lightning Prediction System. 888-571-1212.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowances shall include actual sub-contractor costs. All costs associated with materials and equipment shown on the drawings, general conditions, overhead and profit, etc. shall be included in the Base Bid.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the sub-contract amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.
3. Owner reserves the right to review sub-contract for the Lump Sum Allowance items.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump Sum Allowance: Security System, inclusive of cameras and DVR: include the sum of $50,000.

B. Allowance No. 2: Lump-Sum Allowance: ThorGuard Lighting Prediction System. Include the sum of $7,000 for Lighting Prediction System.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. Description: Unsatisfactory soil excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 312000 "Earth Moving."
2. Unit of Measurement: Cubic yard of soil excavated, based on survey of volume removed.

B. Unit Price No. 2: Rock excavation and replacement with satisfactory soil material.

1. Description: Classified rock excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, according to Section 312500 "Structural Excavation and Backfill."
2. Unit of Measurement: Cubic yard of rock excavated, based on survey of volume removed.

C. Unit Price No. 3 – Shade Structure Type ‘A’.

1. Description: Shade Structure, Type ‘A’, inclusive of foundations and installation, according to Drawings and Section 129300 "Site Furnishings"
2. Unit of Measurement: Per shade structure Type ‘A’.

D. Unit Price No. 4 – Shade Structure Type ‘B’.

1. Description: Shade Structure, Type ‘B’, inclusive of foundations and installation, according to Drawings and Section 129300 "Site Furnishings"
2. Unit of Measurement: Per shade structure Type ‘B’.

E. Unit Price No. 5 – Park Bench.

1. Description: Park Bench, inclusive of foundations and installation, according to Drawings and Section 129300 "Site Furnishings"
2. Unit of Measurement: Per park bench.

F. Unit Price No. 6 – Trash / Recycling Receptacle.

1. Description: Trash / Recycling Receptacle, inclusive of installation, according to Drawings and Section 129300 "Site Furnishings"
2. Unit of Measurement: Per park receptacle.

G. Unit Price No. 7 – Bike Rack.

1. Description: Bike Rack, inclusive of installation, according to Drawings and Section 129300 "Site Furnishings"
2. Unit of Measurement: Per park bike rack.

END OF SECTION 012200

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

B. See also Bid Requirements and Conditions for procedures for Alternates that are not listed in the Bid Documents.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 01: Overlook Deck.

1. Base Bid: No Work
2. Alternate #1: Add foundations, carpentry, railings, etc. for the construction of the overlook deck.

B. Alternate No. 02: Upgrade Gravel Turnaround to Pavement.

1. Base Bid: Provide turnaround in gravel, as indicated.
2. Alternate #2: Upgrade pavement to Bituminous Paving.

C. Alternate No. 03: Playscape Surfacing and Underdrainage.

1. Base Bid: No Work
2. Alternate #3: Provide playscape surfacing and underdrainage, as shown.

D. Alternate No. 4: Additional Gravel Parking.

1. Base Bid: No Work
2. Alternate #4: Add gravel parking, as shown.

E. Alternate No. 5: Resurface Gravel Lot near Chalet.

1. Base Bid: No Work
2. Alternate #5: Resurface gravel lot, as shown.

F. Alternate No. 6: Lawn Seating and Concrete Walks.

1. Base Bid: Grade area and seed with lawn.
2. Alternate #6: Provide lawn seating and concrete walks as shown.

G. Alternate No. 7: Selective Plantings.

1. Base Bid: Provide plantings noted in the Documents as Base Bid.
2. Alternate #7: Provide additional plantings noted as Alternate #7.

H. Alternate No. 8: Selective Timber Guiderails.

1. Base Bid: Provide guiderails noted in the Documents as Base Bid.
2. Alternate #8: Provide additional guiderail noted as Alternate #8.

I. Alternate No. 9: East Climbing Wall.

1. Base Bid: No Work
2. Alternate #9: Provide Climbing Wall as specified in Section 131500 “Pool Systems and Equipment”; 2.15, B1.

J. Alternate No. 10: West Climbing Wall.

1. Base Bid: No Work
2. Alternate #10: Provide Climbing Wall as specified in Section 131500 “Pool Systems and Equipment”; 2.15, B2.

K. Alternate No. 11: Bathhouse Dormers.

1. Base Bid: Provide dormers in their entirety as shown.
2. Alternate #11: Provide deduct to remove dormers and provide single plane shed roofs at the bathhouse.
    a. At east wing, framing between column lines B and F to match framing between column lines A and A.7.
    b. At west wing, framing between column lines C.4 and E.7 to match framing between column lines B.1 and B.7.

END OF SECTION 012300

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. The Owner may, in accordance with General Conditions Article 17 and this Section, without invalidating the Contract, order changes in the Work, the Contract Price and Contract Time being adjusted accordingly.

C. Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated elsewhere in the Contract Documents.

D. Changes in the Work shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

E. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

F. Related Sections include the following:

1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.
2. General Conditions Article 17 “Changes.”
3. Supplemental General Conditions Article 28, “Change Order Limitation.”

1.3 MINOR CHANGES IN THE WORK

A. Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Price or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

B. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on a document G710, "Architect's Supplemental Instructions" or other form acceptable to the Architect and Owner.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests or other form acceptable to the Architect and Owner.

1.5 CHANGE ORDER PROCEDURES

A. In accordance with the General Conditions and / or on Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701, or other form acceptable to the Architect and Owner.

B. A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect, stating their agreement upon all of the following:

1. change in the Work;
2. the amount of the adjustment, if any, in the Contract Price; and
3. the extent of the adjustment, if any, in the Contract Time.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Price or Contract Time, or both.

B. A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

C. If the Construction Change Directive provides for adjustments to the Contract Price, the adjustment shall be based on one of the following:

1. mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
2. unit prices subsequently agreed upon;
3. cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
4. As provided for in sub-paragraph F of this paragraph.

D. Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor’s agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Price or Contract Time.

E. A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in Contract Price and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

F. If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. In such case, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs shall be limited to the following:

1. costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
2. costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
3. rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
4. costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
5. additional costs of supervision and field office personnel directly attributable to the change.

The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Price shall be actual net cost as confirmed by the Architect. 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, if any, with respect to that change.

Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties' agreement with part or all of such costs. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. That determination of cost shall adjust the Contract Price on the same basis as a Change Order, subject to the right of either party to disagree and assert a claim in accordance with the General Conditions.

When the Owner and Contractor agree with the determination made by the Architect concerning the adjustments in the Contract Price and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

G. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

H. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
2. Division 1 Section "Allowances" for administrative requirements governing use of allowances.
3. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with Continuation Sheets.
b. Submittals Schedule.
c. Contractor's Construction Schedule.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

a. Project name and location.
b. Name of Architect.

c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Submit draft of AIA Document G703 Continuation Sheets.
3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value as described in the General Conditions.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Price.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Provided that the Application for Payment is received by the Architect not later than the fifth (5th) day of the month, the Owner shall make payment to the Contractor not later than the fifth (5th) day of the next month. If an Application for Payment is received by the Architect after the the application date fixed above, payment shall be made by the Owner not later than forty-five (45) days after the Architect receives the Application for Payment.

1. In order to facilitate payments, the Contractor shall provide a pencil copy of the Application for Payment for review by the Architect, at the scheduled project meeting prior to the 5th day of the month. The pencil copy shall be reviewed and comments forwarded by the Architect no later than the 1st day of the month.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets, or forms acceptable to the Owner and Architect, as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of Public Health Approvals
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.

G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination.
2. Administrative and supervisory personnel.
3. Project meetings.

B. Related Sections include the following:

1. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
2. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project Superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.6 PROJECT MEETINGS

A. General: Project Meetings are for the Contractor's coordination of work with their own personnel and any sub-contractors, suppliers, etc. as may be required. Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Critical work sequencing and long-lead items.
    c. Designation of key personnel and their duties.
    d. Procedures for processing field decisions and Change Orders.
    e. Procedures for requests for interpretations (RFIs).
    f. Procedures for testing and inspecting.
    g. Procedures for processing Applications for Payment.
    h. Distribution of the Contract Documents.
    i. Submittal procedures.
    j. Preparation of Record Documents.
    k. Use of the premises.
    l. Work restrictions.
    m. Owner's occupancy requirements.
    n. Responsibility for temporary facilities and controls.
    o. Construction waste management and recycling.
    p. Parking availability.
    q. Office, work, and storage areas.
    r. Equipment deliveries and priorities.
    s. First aid.
    t. Security.
    u. Progress cleaning.
    v. Working hours.

3. Minutes: Architect will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. The Contract Documents.
    b. Options.
    c. Related requests for interpretations (RFIs).
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written recommendations.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Architect will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Architect will distribute minutes of the meeting to each party present and to parties who should have been present. Contractor shall distribute to all other parties who may need the information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in

planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) Requests for interpretations (RFIs).
        16) Status of proposal requests.
        17) Pending changes.
        18) Status of Change Orders.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.

3. Minutes: Architect will record and distribute to Contractor the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

    a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
2. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
3. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

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.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Event: The starting or ending point of an activity.

C. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

D. Major Area: A story of construction, a separate building, or a similar significant construction element.

E. Milestone: A key or critical point in time for reference or measurement.

1.4 SUBMITTALS

A. Qualification Data: For scheduling consultant.

B. Submittals Schedule: Submit three (3) copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

C. Preliminary Construction Schedule: Submit three (3) opaque copies.

D. Contractor's Construction Schedule: Submit three (3) opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

E. Daily Construction Reports: Submit two (2) at monthly intervals.

F. Material Location Reports: Submit two copies at monthly intervals.

G. Field Condition Reports: Submit two (2) copies at time of discovery of differing conditions.

H. Special Reports: Submit two (2) copies at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: At preconstruction meeting called for in Specification Section 013100 discuss the project scheduling, including, but not limited to, the following:

1. Verify availability of qualified personnel needed to develop and update schedule.
2. Discuss constraints, including work stages, area separations, interim milestones and partial Owner occupancy.
3. Review time required for review of submittals and resubmittals.
4. Review requirements for tests and inspections by independent testing and inspecting agencies.
5. Review time required for completion and startup procedures.
6. Review and finalize list of construction activities to be included in schedule.
7. Review submittal requirements and procedures.
8. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows a change in the specified completion date, unless specifically authorized by Change Order.

C. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than twenty (20) days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

    a. Swimming Pool Equipment
    b. Splash Pad Equipment
    c. Waterslide
    d. Light Fixtures
    e. Plumbing Equipment and Fixtures

3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than ten (10) days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.

g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:

1. Health Department and Building permit Approvals
2. Various stages of concrete placement
3. Swimming Pool Equipment installation

F. Cost Correlation

1. Refer to General Conditions Article 24 for cost correlation in the schedule.
2. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.
3. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Price.
4. Each activity cost shall reflect an accurate value subject to approval by Architect.
5. Total cost assigned to activities shall equal the total Contract Price.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven (7) days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for the duration of construction. Include a cash requirement prediction based on indicated activities.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Submit a comprehensive, fully developed Contractor's Construction Schedule within thirty (30) days of date established for the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in ten (10) percent increments within time bar.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one (1) day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule a minimum of one (1) day before regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for submitting Coordination Drawings.
2. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Submittals Schedule.
3. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for erecting mockups.
4. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Allow fifteen (15) days for processing each resubmittal.
6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 1/2 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Unique identifier, including revision number.
    i. Specification Section and/or Drawing number and detail references, as appropriate.
    j. Other necessary identification.

G. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

H. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
3. Transmittal Form: Use AIA Document G810 or form acceptable to Architect, which contains the same information.
4. Provide copy of each transmittal to Owner.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit five (5) copies of each submittal, unless otherwise indicated or agreed. Architect will return copies to the Owner and consultants as required. Remaining sets will be returned to the Contractor. Mark up and retain one returned copy as a Project Record Document.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.

e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operating and maintenance manuals.
k. Compliance with recognized trade association standards.
l. Compliance with recognized testing agency standards.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 24 by 36 inches.
4. Number of Copies: Submit one correctable, translucent, reproducible print and four blue- or black-line prints of each submittal. Architect will return the reproducible print and any copies not retained or provided to Owner and consultants.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

E. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

    a. Generic description of Sample.
    b. Product name or name of manufacturer.
    c. Sample source.

5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:

    a. Size limitations.
    b. Compliance with recognized standards.
    c. Availability.
    d. Delivery time.

6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

    a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of the variations.
    b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
7. Number and size of Samples: Refer to individual Specification Sections for requirements for number and size of required samples.

8. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

G. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
2. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

J. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

K. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

L. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

M. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

N. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures and Operation and Maintenance Data."

P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals,

the Contractor represents tht the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the reuirements of the Work and of the Contract Documents.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

	Approved	Fabrication/Installation MAY be undertaken. Architect's approval does not authorize changes in the Contract Sum or Contract Time.
	Approved as Noted	
	Revise and Resubmit	

	Revise and Resubmit	Fabrication/Installation MAY NOT be undertaken.
	Rejected	

Architect's review is limited to conformance with the intent of the Contract Documents. This review shall not limit the Contractor's obligation for compliance with the Contract Documents. The Contractor is responsible for details and accuracy, quantities, field conditions and dimensions, fabrication, assembly, safe installation, and coordination of all related work.

TLB Architecture, LLC

By: Date:

C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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 requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems 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.

D. Fabricator Qualifications: A firm experienced in producing products 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.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.

2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow five (5) days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Price will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed or within the time frame specified by the testing agency when retained.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect, Owner and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within fifteen (15) days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency and/or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency and/or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

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 Architect and Contractor 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 Architect 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. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

A. A Testing Agency who is licensed to practice in the State of Connecticut, and who has been in business, with a track record of success, for a minimum of five consecutive years. Testing Agency shall be agreeable to Owner and Architect. If Testing Agency is retained by the Owner and the Contractor has reasonable objection to said Agency, the objection shall be in the form of a written explanation for review and action by the Owner and Architect.

3.2 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use. Generally retain paragraph below; revise to suit Project. See Evaluations.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents 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. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.access.gpo.gov/nara/cfr	(888) 293-6498 (202) 512-1530
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point www.dodssp.daps.mil	(215) 697-6257
	Available from General Services Administration www.apps.fss.gsa.gov/pub/fedspecs/index.cfm	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-5434

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.aashto.org	(202) 624-5800
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AFPA	American Forest & Paper Association (See AF&PA)	
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association www.hardboard.org	(847) 934-8800
AI	Asphalt Institute	(859) 288-4960

	www.asphaltinstitute.org	
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCA	Architectural Spray Coaters Association www.ascassoc.com	(856) 848-6120
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International	(610) 832-9585

	(American Society for Testing and Materials International) www.astm.org	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FCI	Fluid Controls Institute www.fluidcontrolsinstitute.org	(216) 241-7333

FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fscoax.org	52 951 5146905
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association) www.glasswebsite.com	(785) 271-0208
GRI	Geosynthetic Research Institute www.drexel.edu/gri	(215) 895-2343
GTA	Glass Tempering Division of Glass Association of North America (See GANA)	
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234

LMA	Laminating Materials Association www.lma.org	(201) 664-2700
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
LSGA	Laminated Safety Glass Association (See GANA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NAAMM	North American Association of Mirror Manufacturers (See GANA)	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NFPA	NFPA International (National Fire Protection Association International) www.nfpa.org	(800) 344-3555 (617) 770-3000

NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (508) 230-3516
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265

SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. www.bocai.org	(708) 799-2300
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials (The) www.iapmo.org	(909) 595-8449
ICBO	International Conference of Building Officials www.icbo.org	(800) 284-4406 (562) 699-0541
ICBO ES	ICBO Evaluation Service, Inc. www.icbo.org/ICBO_ES/	(800) 423-6587
ICC	International Code Council, Inc. (Formerly: CABO - Council of American Building Officials) www.intlcode.org	(703) 931-4533
SBCCI	Southern Building Code Congress International, Inc. www.sbcci.org	(205) 591-1853

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-0990
DOC	Department of Commerce www.doc.gov	(202) 482-2000
EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(202) 708-5082
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley Laboratory (See LBNL)	
LBNL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-5605
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
RUS	Rural Utilities Service (See USDA)	(202) 720-9540

SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, security and protection facilities, and Project Sign requirements.

B. Related Sections include the following:

1. Division 1 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Division 1 Section "Execution Requirements" for progress cleaning requirements.
4. Divisions 2 through 33 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

1.8 STORMWATER AND DEWATERING FROM CONSTRCUTION ACTIVITIES

A. The Contractor shall comply with the Construction General Permit for discharges for storm-water and dewatering wastewater from construction activities. Construction activities shall not commence prior to approval by State of CT, Department of Energy and Environmental Protection (DEEP).

B. The Construction General Permit dictates separate compliance procedures for Locally Approvable projects and Locally Exempt projects (as defined in the permit). Locally Exempt construction projects disturbing over 1 acre must submit a registration form and Stormwater Pollution Control Plan (SWPCP) to the Department. Locally Approvable construction projects with a total disturbed area of one to five acres are not required to register with the Department provided the development plan has been approved by a municipal land use agency and adheres to local erosion and sediment control land use regulations and the CT Guidelines for Soil Erosion and Sediment Control. Locally Approvable construction projects with a total disturbed area of five or more acres must submit a registration form to the DEEP. The city will initiate, prior to Contract, the preparation of the SWPCP by a Qualified Professional who designed the project, and will obtain certification by a Qualified Professional or regional Conservation District who reviewed the SWPCP and deemed it consistent with the requirements of the general permit. For scheduling purposes, the Contractor shall be made aware that the SWPCP is currently in preparation and will need to be reviewed and certified by a Qualified Professional or regional Conservation District prior to registering, and that the general permit requires that the registration (which includes certification signatures from the Contractor and all subcontractors) must be submitted at least sixty (60) days prior to the planned commencement of the construction activity.

PART 2 - PRODUCT

2.1 MATERIALS

A. Pavement: Comply with Division 32 Section "Asphalt Paving."

B. Temporary Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.

C. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Contractor may, at his option provide prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading –or- use space within the existing bathhouse building, until such time as the building is planned for demolition or reuse.

B. Common-Use Field Office: Contractor may, at his option provide prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading –or- use space within the existing building, until such time as the building is planned for demolition or reuse. Offices shall be of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Area of sufficient size to accommodate meetings of ten (10) individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with table, chairs, and 4-foot- square tack board.
3. Drinking water.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2. Non-combustible materials may be stored in unused portions of the building. Any damage to such areas shall e restored to its original condition by the Contractor, at no cost t the Owner.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system or as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Contractor may, at his option and to the extent practical, use sanitary facilities within the existing bathhouse, until such time it is planned for demolition or reuse. The existing building does not have a heating system, so temporary heat would be required to prevent freezing of pipes during cold weather.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: 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 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.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Connect temporary service to power source, as directed by Utility Company and Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line. At Contractor’s option, cellular service can be used in lieu of a hard line, provided wireless coverage is adequate and the phone number is provided to all parties that may require it.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line if a facsimile machine and/or computer is provided.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Architect's office.
e. Engineers' offices.
f. Owner's office.
g. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated and, if not indicated, within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel, within construction area. At no times shall parking by construction personnel be allowed at the existing parking lot, or on the streets.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: 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.

B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 Section "Site Clearing."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of the Drawings and authorities having jurisdiction.

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations and as indicated on Drawings.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Owner will double lock gated entrances by installing a second padlock on the chain securing the gates. This will be used by Owner for emergency access only, or as deemed necessary.

F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

I. Dust Protection: Provide adequate dustproof measures to limit dust and dirt migration and to separate construction area from fumes and noise.
1. Construct dustproof partitions with 2 layers of 3-mil polyethylene sheet on each side. Cover floor with 2 layers of 3-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
2. Protect air-handling equipment.
3. Weather strip openings.
4. Provide walk-off mats at each entrance through temporary partition.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in all areas of Town-owned property.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

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.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
b. Arborist's responsibilities.
c. Quality-control program.
d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.
f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of trenching by hand or with air spade within protection zones.

C. Samples: For each type of the following:

1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist-Municipal Specialist as certified by ISA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil.
2. Planting Soil: Planting soil as specified in Section 329115 "Soil Preparation (Performance Specification)."

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural, brown.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch-diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch-OD line posts, and 2-7/8-inch-OD corner and pull posts; with 0.177-inch-diameter top tension wire and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

    a. Height: 48 inches.

2. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 96 inches apart.

    a. Height: 48 inches.
    b. Plywood and Lumber: Comply with requirements in Section 061200 "Miscellaneous Rough Carpentry."

3. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

    a. Height: 48 inches.

b. Color: High-visibility orange, nonfading.

4. Gates: Single- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
1. Lettering: 3-inch- high minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than one sign with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 6 inches inside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

    a. Type of Pruning: Cleaning, raising, reducing and thinning where indicated.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and stockpile in areas approved by Architect.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
2. Large Trees: Provide two new tree(s) of 3 inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.

a. Species: As selected by Landscape Architect.

3. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 3 inch uniform thickness to remain.

D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Division 1 Section "Alternates" for products selected under an alternate.
2. Division 1 Section "References" for applicable industry standards for products specified.
3. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
4. Divisions 2 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. 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.

1. 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.
2. 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.
3. 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.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," 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.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within thirty (30) days after date of commencement of the Work, submit three (3) copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within forty-five (45) days after date of commencement of the Work, submit three (3) copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within ten (10) days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A or other form acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. 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.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. 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.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. 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.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order.
b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site 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 installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Except where noted as “No Substitutions”, Architect will consider requests for substitution if received within sixty (60) days after the Notice to Proceed, or as specified in other Sections. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

2.4 PRODUCTS IDENTIFIED AS “NO SUBSTITUTIONS”

1. In order to standardize certain equipment across the City, certain products are identified as “No Substitutions”. These products, when so noted, shall be provided as specified. Alternative products or substitutions shall no be considered, regardless of whether the product is equivalent to the specified item or not.

PART 3 EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Submittal Procedures" for submitting surveys.
3. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Certified Surveys: Submit three (3) copies signed by land surveyor.

D. Final Property Survey: Submit three (3) copies showing the Work performed and record survey data.

E. Electronic File Survey: Submit electronic file in .dwg and .pdf formats for project archive purposes.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

    a. Description of the Work.
    b. List of detrimental conditions, including substrates.
    c. List of unacceptable installation tolerances.
    d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation." or another form acceptable to the Architect.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will provide survey of the property to identify existing benchmarks, property corners and elevations.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show 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.

F. Underground Piping, Utility and Improvements Survey: Prepare a final survey showing layout, elevations, size and type of underground piping and utilities, tanks, structures or improvements for Project. Include on the survey a certification, signed by land surveyor, that the information is accurately shown on the survey.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. 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.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. 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.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Sections include the following:

1. Division 1 Section "Temporary Facilities and Controls" for environmental-protection measures during construction.
2. Division 2 Section "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of equipment, demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE GOALS

A. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:

1. Demolition Waste:

a. Asphaltic concrete paving.
b. Concrete and concrete masonry.
c. Clay brick masonry
d. Concrete reinforcing steel.
e. Piping.
f. Supports and hangers.
g. Valves and equipment.

2. Construction Waste:

a. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 SUBMITTALS

A. Waste Management Plan: Submit three (3) copies of plan within seven (7) days of date established for commencement of the Work.

B. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt. Contractor shall be the beneficiary of any deductions.

C. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt. Contractor shall be the beneficiary of any proceeds.

D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification and waste reduction work plan. A cost/revenue analysis shall be made available to the Owner at Project Closeout. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.

8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Architect and Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three (3) days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack, crate or otherwise protect items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility, to the extent practical.

B. Concrete: Contractor’s option to break up and transport paving to concrete-recycling facility, to the extent practical, or, crush concrete and screen to comply with requirements in Division 31 Section "Earthwork" for use as satisfactory soil for common fill.

C. Metals: Separate metals by type.

D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

E. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

H. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site.
4. Crates: Break down crates into component wood pieces and recycle to the extent practical.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017500 - INDEPENDENT TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 WORK INCLUDED

A. The Owner shall, after taking bids, engage the services of an independent testing laboratory approved by the Architect, to perform inspections and tests of construction materials.

B. In addition, the Owner may perform plant, field and laboratory inspection and testing of these various materials, to check compliance with the Specification requirements. Frequencies and location of samples shall be established by the Architect. The Contractor and Subcontractor shall furnish all materials for testing.

C. The Owner's representative shall be permitted access to fabricating and erection operations and to storage areas of completed work. The Architect shall be kept informed as to schedule and progress of shop fabricating and field erections, to permit scheduling of inspections.

D. Contractors shall cooperate with laboratory as follows:

1. Make available without costs samples of all materials to be tested.

2. Furnish such nominal labor as is necessary to obtain samples at the project. to assist in making tests, and to patch sampled areas.

3. Advise the laboratory sufficiently in advance of operations to allow for completion of initial tests and assignment of inspection personnel.

E. If, after initial tests have been performed, any material and/or workmanship are rejected by the testing laboratory responsible, Contractor shall pay for any subsequent testing required for materials which have been rejected and/or replaced.

F. Any materials and workmanship which are rejected by the testing laboratory by reason of failure to conform to the requirements of the Contract Documents, shall be removed and replaced at the Contractor's expense. See also Supplementary Conditions.

G. Written reports covering each inspection and test will be furnished promptly by the laboratory to the Architect, Engineer, Contractor, and such other persons whom the Architect may specify.

1.02 TESTING METHODS

A. Tests and inspections will be conducted in accordance with the requirements of these Specifications, or if not herein specified, in accordance with the latest standards of the ASTM or other recognized authorities.

1.03 LABORATORY SERVICES REQUIRED

A. The attached Statement of Special Inspections outlines anticipated testing.

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Closeout inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for requirements for Substantial and Final Completion procedures.
2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Division 1 Section "Demonstration and Training" for requirements for instruction of Owner's personnel.
6. Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, the Engineer and / or his representative or representatives of the governing authority, and the Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty, if applicable.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, the Engineer and / or his representative or representatives of the governing authority, and the Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list by site.
2. Organize list of spaces in sequential order, starting with exterior areas first and proceeding through the building(s).
3. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
4. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect .
    d. Name of Contractor.
    e. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by 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.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. 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.

B. 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.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical, electrical and swimming pool equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. 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.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Whwre applicable, engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. 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.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit two (2) draft copies of each manual at least fifteen (15) days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least fifteen (15) days before final inspection. Architect will return copy with comments within fifteen (15) days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit three (3) copies of each corrected manual within fifteen (15) days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.

2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

6. Photographs: Where test and / or drawings cannot adequately describe the intended message, use photographs with explanatory notations and marks to supplement text and drawings.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.
9. Injury or Accident.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.

3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.

3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Final Map for Filing

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for general closeout procedures.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit two (2) sets of marked-up Record Prints.

B. Record Specifications: Submit two (2) copies of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit two copies of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. 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.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground piping, tanks, structures and utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. 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.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. 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.

2. Identification: As follows:

   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 FINAL MAP FOR FILING

A. Final survey of property shall be provided to the City of New Britain:

1. Three paper copies with Land Surveyors seal and signature.

2. Electronic copy of survey in “.dwg” and .pdf format.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for requirements for pre-instruction conferences.
2. Divisions 2 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 SUBMITTALS

A. Instruction Program: Submit two (2) copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one (1) complete training manual(s) for Owner's use.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
1. Equipment, including swimming pool recirculation, filtration and chemical control systems, as well as all associated systems and components.
2. Heat generation, including hot water heaters and water distribution piping.
3. HVAC systems, including ventilation systems and controls.
4. Electrical service and distribution, including transformers, switchboards, panelboards motor controls and disconnects.
5. Lighting equipment and controls.
6. Winterization of swimming pool and building systems.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.

e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.
d. Project Record Documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.

b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Provide qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven (7) days' notice.

C. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 024116 - STRUCTURE DEMOLITION

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. Demolition and removal of buildings, swimming pool and site improvements.
2. Abandoning in-place and removing below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place or removing site utilities.
4. Salvaging items for reuse by Owner.

B. Related Requirements:

1. Section 011000 "Summary" for use of the premises and phasing requirements.
2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
3. Section 024119 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store for reuse in the new facility. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

D. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before the Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.

2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

E. On-site storage or sale of removed items or materials is not permitted.

1.9 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations, including full use of building and pools for the 2017 swim season, should the new pool not be Substantially Complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving".

PART 3 - EXECUTION

3.1 DEMOLITION CONTRACTOR

A. Demolition Contractor:

1. Demolition contractor shall be licensed by the State of Connecticut for demolition work.

3.2 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform or engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

D. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Section 013233 "Photographic Documentation.

3.3 PREPARATION

A. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to new construction area.
4. Protect items from damage during transport and storage.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off utilities when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.5 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.6 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

D. Non-explosive controlled demolition of concrete is acceptable, provided it executed by experienced and licensed contractors.

3.7 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings.

D. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.

E. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.

1. Remove below-grade construction, including swimming pool walls, slab and tunnels, foundation walls, and footings, to depths indicated.

F. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction or that are encountered during excavation. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."

G. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.8 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."

B. Site Grading: Coordinate rough grading with new Work..

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of waste according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 032500 - CONCRETE WATERSTOPS and MODULAR PIPE SEALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Conditions and Division 1, General Requirements apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. The extent of miscellaneous specialties work is as shown on the drawings and specified herein, including:

- Hydrophilic Waterstop
- PVC Waterstops
- Retrofit PVC Waterstops
- Modular Pipe Seals
- Installation of Above

1.3 SUBMITTALS

A. Submit manufacturer's cuts, installation details and /or shop drawings of all items specified in accordance with the Supplementary Conditions.

B. Submit actual sample of each type proposed for the work. Sample to be minimum one foot long.

1.4 REFERENCE STANDARD SPECIFICATIONS FOR WATERSTOPS

A. HYDROPHILIC WATERSTOP

1. American Society of Testing Materials (ASTM)

B. PVC WATERSTOP

1. Bureau of Reclamation: CC-902
2. Canadian General Standards Board: 41-GP-35M Types 1&3
3. Corps of Engineers: CRD-C-572-74
4. Department of Agriculture - Soil Conservation Service Material Specification 537
5. Federal Specifications: Std. 601

C. MODULAR PIPE SEALS:

1. American Society of Testing Materials (ASTM)
2. Factory Mutual (FM)
3. National Sanitation Foundation (NSF)

1.5 DELIVERY, STORAGE AND HANDLING

A. Store waterstop and modular pipe seals under tarps to protect from oil, dirt and sunlight and premature exposure to water for hydrophilic materials.

PART 2 - PRODUCTS

2.1 HYDROPHILIC WATERSTOP FOR NON-MOVING CONTRACTION AND CONSTRUCTION JOINTS

A. Provide HYDROTITE hydrophilic waterstop as supplied by Sika / Greenstreak. Waterstop to be dual extrusion type, shape and size as required for joint.

1. At Construction joints provide HYDROTITE CJ Type
2. At Control Joints provide HYDROTITE RSS Type
3. At Pipe Penetrations provide HYDROTITE DSS Type

B. Material shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.

C. Waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.

D. Physical and performance requirements:

CHLOROPRENE RUBBER

Property	Test Method	Required Limits
Tensile Strength	ASTM D- 412	1300 psi min.
Ultimate Elongation	ASTM D- 412	400% min.
Hardness	ASTM D-2240	50 +/- 5 Shore A
Tear Resistance	ASTM D-624	100 lb./inch

MODIFIED CHLOROPRENE (HYDROPHILIC) RUBBER

Property	Test Method	Required Limits
Tensile Strength	ASTM D- 412	350 psi min.
Ultimate Elongation	ASTM D- 412	600% min.
Hardness	ASTM D-2240	52 +/- 5 Shore A
Expansion Ratio	Volumetric Change distilled water at 70 degrees F	3 to 1 min.
Tear Resistance	ASTM D-624	50 lb./inch

2.2 PVC WATERSTOPS FOR EXPANSION JOINTS

A. Provide flexible PVC (polyvinyl chloride) waterstop as manufactured by Sika Westec, Barrier Technologies / Greenstreak or approved equivalent. Profile style number to be as follows:

Ribbed Waterstop:	6", #619, 7/16" – Envirostop
Large Retrofit (for 10" or larger walls):	5" x 2 ½", #630 - Envirostop
Small Retrofit: (for less than 10" walls):	3 5/16" x 2 9/16", #629 - Envirostop

B. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.

C. Performance requirements are as follows:

Property	**Test Method**	**Required Limits**
Water Absorption	ASTM D 570	5% max.
Tear Resistance	ASTM D 624	285 lb./in min.
Ultimate Elongation	ASTM D 638	360% min.
Tensile Strength	ASTM D 638	2000 psi min.
Low Temp. Brittleness deg. F	ASTM D 746	no failure @ 35
Stiffness in Flexure	ASTM D 747	600 psi min.
Specific Gravity	ASTM D 792	1.4 max.
Ozone Resistance	ASTM D 1149	No Failure
Volatile Loss	ASTM D 1203	0.50 % max.
Hardness Shore A	ASTM D 2240	65 to 80
Tensile Strength after Accelerated Extraction	CRD-CC 572	1600 psi min.
Elongation after Accelerated Extraction	CRD-C 572	300% min.
Effect on Alkali		
After 7 Day	CRD-C 572	
Weight Change		+0.25% max.,- 0.0% min.
Hardness Change		+- 5% max.

2.3 MODULAR PIPE SEALS

A. Use a modular, mechanical seal, consisting of rubber links shaped to continuously fill the annular space between the pipe and the wall opening.

B. Seals shall be equivalent to Link-Seal® with pressure plates molded of glass reinforced nylon. Hardware shall be 316 Stainless Steel. Coloration shall be throughout elastomer for positive field inspection. Each link shall have permanent identification of the size and manufacturer's name molded into the pressure plate and sealing element. The Contractor will submit to verify the modular seals are domestically manufactured at a

plant with a current ISO-9001:2000 registration. Copy of ISO-9001:2000 registrations shall be a submittal item.

C. Basis of Design: PSI-Thunderline/ Link-Seal® Modular Seal as manufactured by Pipeline Seal & Insulator, Inc, Houston, TX, or pre-approved equal.

Material Properties for Modular Pipe Seals

PROPERTY	ASTM METHOD	EPDM (EPDM L)	NITRILE	SILICONE
Hardness (shore A)	D-2240	50 ±5 (40 ±5)	50 ±5	50 ±5
Tensile	D-412	1450 psi	1300 psi	860 psi
Elongation	D-412	400%	300%	250%
Compression Set	S-395	15% 22 hrs. @ 158ºF (70ºC)	45% 22 hrs. @ 212ºF (100ºC)	40% 22 hrs. @ 350ºF (177ºC)
Specific Gravity	D-297	1.10	1.15	1.40

2.3 ACCESSORIES

A. HYDROPHILIC WATERSTOPS

1. Provide Greenstreak Rubber Adhesive to secure HYDROTITE to smooth, dry concrete.

2. Provide Greenstreak 7300 two-component epoxy gel to secure HYDROTITE to rough, wet (or dry) concrete.

3. Provide LEAKMASTER single component hydrophilic sealant to secure HYDROTITE to rough, dry concrete.

4. Provide cyanacrylate adhesive (super glue) for butt joining and mitering HYDROTITE.

5. Provide LEAKMASTER in addition to cyanacrylate adhesive at all splices for added insurance.

B. PVC WATERSTOPS

1. Provide factory made waterstop fabrications for all changes of direction, intersections and transitions leaving only straight butt joint splices in the field.

2. Provide hog rings or grommets spaced at 12" on centers along length of waterstop and wire tie to adjacent reinforcing steel.

PART 3 - EXECUTION

A. HYDROPHILIC WATERSTOP

1. Cut coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.

2. Splices shall be sealed using cyanacrylate (super glue) and LEAKMASTER.

3. Seal watertight any exposed cells of HYDROTITE using LEAKMASTER.

4. Follow approved manufacturer recommendations. Do not install hydrophilic waterstops until just before assemblies that will cover them are installed (ie. sealants, concrete pours, etc.).

B. PVC WATERSTOPS

1. Field butt splices shall be heat fused welded using Teflon covered thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer's recommendations. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.

2. Layout waterstop to minimize number of joints. Use longest practical lengths. Seams where not required shall not be allowed.

3. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12" on centers along the length of the waterstop and wire tie to adjacent reinforcing.

B. MODULAR PIPE SEALS

1. Size and install all modular pipe seals per manufacturer’s strict written instructions for the penetration and pipe size requiring seals.

END OF SECTION 032500

SECTION 033000 - CAST IN PLACE CONCRETE

PART 1-GENERAL:

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. The extent of cast-in-place concrete work shown on drawings.

Related work specified elsewhere.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified. For the codes and standards listed in this section and in subsequent sections, follow the latest edition recognized by building authority having jurisdiction at the time of construction.

1. "Specifications for Structural Concrete for Buildings", American Concrete Institute, (ACI 301).

2. "Building Code Requirements for Reinforced Concrete", ACI-318

3. Concrete Reinforcing Steel Institute, CRSI, "Manual of Standard Practice"

4. "Standard Specification for Ready-Mixed Concrete" ASTM C 94

B. Concrete Testing Service: Employ, at Contractor's expense, a testing laboratory acceptable to Engineer to perform material evaluation tests for concrete mix designs and to design concrete mixes.

C. Materials and installed work may require testing and retesting, as directed by Engineer, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

D. Inspection: The Owner will engage the services of a qualified "Testing Laboratory" for this project. The testing lab, as a representative of the Owner, will provide testing requirements, as necessary.

E. Sampling and testing for quality assurance during placement of concrete includes the following:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

2. Slump: ASTM C 143; one test for each concrete load at point of discharge from truck, and one test for each set of compressive strength test specimens.

3. Air Content: ASTM C 231, one for each set of compressive strength test specimens.

4. Concrete Temperature: Test hourly when air temperature is 40 degrees F. (4 degrees C.) and below, and when 80 degrees F (27 degrees C), and above; and each time a set of compressive test specimens are made.

5. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required.

6. Compressive Strength Tests: ASTM C 39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

   When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

   When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

F. Test results will be reported to Engineer and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, name of concrete supplier, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, air content, slump, concrete temperature, compressive breaking strength and type of break for both 7 day tests and 28 day tests.

G. Additional Tests: The testing service will make additional tests of in place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when concrete placed does not conform to the specified limits of the Contract Documents or when unacceptable concrete is verified.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, and others as requested by Engineer.

B. Shop Drawings Reinforcement: Submit shop drawings electronically in PDF format with the ability for reviewers to comment and re-save the file for; fabrication, bending, and placement of concrete reinforcement. Comply with ACI Detailing Manual, Publication SP-66, showing bar schedules, stirrup spacing, diagrams of bent bars, placing plans and wall elevations showing arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures. Reproductions of the Engineers Contract Drawings are not acceptable for use as shop drawings.

C. Certificates of Compliance: Provide the Special Inspector with Certificates of Compliance for welded wire fabric, cement, air- entraining agent, water-reducing agent, water stop and vapor barrier.

In addition provide mill test reports for reinforcement bars used for this project.

D. Laboratory Test Reports: Submit for review laboratory test reports for concrete materials and mix design test as specified.

E. For structural concrete slabs, the construction manager (or party responsible for overseeing the various trades) shall compile and submit a single layout drawing showing all proposed slab openings from all applicable trades at the same time as the reinforcement shop drawings.

PART 2 - PRODUCTS

2.1 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-place concrete without bow or deflection.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces, or prevent bonding for architectural finishes.

2.2 REINFORCING MATERIALS:

A. Reinforcing Bars (Rebar): ASTM A 6l5-82 (S1), Grade 60, deformed.

B. Steel Wire: ASTM A 82-79, plain, cold-drawn, steel.

C. Welded Wire Fabric (WWF): ASTM A l85-79, welded steel wire fabric.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use bar type supports complying with CRSI recommendations, unless otherwise acceptable.

1. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected complying with CRSI Class 1 plastic protected bar supports.

2. For slabs on grade, provide chairs with sufficient bearing surface to not sink into bearing material or to puncture vapor barrier. Use of stone, clay brick, or concrete brick is NOT acceptable.

2.3 CONCRETE MATERIALS:

A. Portland Cement: ASTM C l50, Type I, unless otherwise acceptable to the Architect. Use one brand of cement throughout project, unless acceptable to Engineer.

B. Normal Weight Aggregates: ASTM C 33 and as herein specified. Provide aggregates from a single source for exposed concrete.

C. Water: Potable.

D. Air-Entraining Admixture: ASTM C 260.

E. Water-Reducing Admixture: ASTM C 494, Type A and not containing more chloride ions than are present in municipal drinking water.

2.4 RELATED MATERIALS:

A. Vapor Barrier: Provide tear resistant vapor barrier cover over prepared base material. Vapor barrier shall be 15mil ASTM E 1745 Class A with a permeance below 0.01 perms. All joints to be lapped six inches and sealed with manufacturer’s tape. Continue vapor barrier up all adjacent vertical surfaces and seal around all penetrations per the manufacturer’s recommendations. Patch any punctures or tears in material with tape or by taping additional vapor barrier material over the damaged area.

1. Products may be Stego Wrap Vapor Barrier (15mil) by Stego Industries or approved equivalent.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C l7l.

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

4. Membrane-Forming Curing Compound: ASTM C 309, Type I unless other type acceptable to Engineer. Ensure that curing compound is chemically compatible with hardeners, surface treatments and finish coatings that will be used.

2.5 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type and strength of concrete in accordance with ACI 301 Section 3.9 "Proportioning on the Basis of Previous Field Experience or Trial Mixtures", as indicated on drawings.

Use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix design. The testing facility shall not be the same as used for field quality assurance testing unless otherwise acceptable to Engineer.

B. Submit written reports to Engineer for each proposed mix for each class of concrete AT LEAST 15 DAYS PRIOR TO START OF WORK. Do not begin concrete production until mixes have been reviewed and approved by Engineer.

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job condition, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work. Submit adjusted concrete mixes to the Engineer for review AT LEAST 5 WORKING DAYS PRIOR TO USE.

D. Use air-entraining admixture in all concrete exposed to freeze – thaw cycles. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within specified limits.

1. Concrete structures and slabs exposed to freezing and thawing or subject to hydraulic pressure:

3 1/2% to 4 1/2% for maximum 2" aggregate
5 1/2% to 6 1/2% for maximum 3/4" aggregate
6 1/2% to 7 1/2% for maximum 1/2" aggregate

2. Other Concrete: 2% to 4%.

E. Slump Limits: The concrete shall be proportioned and produced to have a slump of 4 inches or less if consolidation is to be by vibration, and 5 inches or less if consolidation is to be by methods other than vibration. A tolerance up to 1 inch above the maximum indicated shall be allowed for one batch in any five consecutive batches tested. Concrete of lower slump may be used provided it is properly placed and consolidated.

F. Do not use admixtures containing calcium chloride.

2.6 CONCRETE MIXING:

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94 "Standard Specification for Ready-Mixed Concrete", and as herein specified.

Addition of water to the batch will not be permitted.
When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing, delivery, and placement time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce time to 60 minutes.

When placement of concrete is likely to occur with air temperatures above 85 degrees F, submit a Hot Weather Concreting Plan to the Engineer for review and approval prior to beginning work. Hot Weather Concreting Plan should comply with ACI 305R.

When placement of concrete is likely to occur with air temperatures below 40 degrees F, submit a Cold Weather Concreting plan to the Engineer for review and approval prior to beginning work. Cold Weather Concreting Plan should comply with ACI 306R.

PART 3 - EXECUTION

3.1 FORMS:

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structures. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. The Contractor is solely responsible for the safe design and installation of formwork and supports.

B. Design Formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, "Recommended Practice for Concrete Formwork", to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set

tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges unless otherwise specified, using wood, metal PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least 1-1/2" inside concrete.

2. Unless otherwise shown, provide form ties which will not leave holes larger than 1" diameter in concrete surface.

H. 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.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Re-tighten forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

3.2 PLACING REINFORCEMENT:

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, old concrete, earth, ice, and other materials, which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required. Concrete bricks are NOT acceptable.

D. Place reinforcement to obtain at least minimum coverages indicated on the Contract drawings for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. All reinforcement must be completely supported and secured against possible displacement prior to placing concrete in any portion of the scheduled placement.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lap splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

F. Concrete reinforcement shall be erected from shop drawings displaying the Engineer's stamp of acceptance only. In the event a conflict exists between the accepted shop drawing and the Contract Documents the conflict shall be brought to the immediate attention of the Engineer for resolution.

3.3 JOINTS:

A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Engineer.

B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

D. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

Joint filler and sealant materials are specified in Division 7.

E. Control Joints in Slabs-on-Ground: Construct control joints in slabs-on-ground to form panels or patterns as shown. Use inserts or saw-cut 1/4" wide x 1/5 to 1/4 of the slab depth, unless otherwise indicated.

3.4 INSTALLATION OF EMBEDDED ITEMS:

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instruction and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.5 PREPARATION OF FORM SURFACES:

A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.6 CONCRETE PLACEMENT:

A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work. Cooperate with other trades in setting such work.

B. Notify testing/inspection agency of intent to place concrete at least 48 hours prior to placement. Perform complete pre-placement inspection of formwork, reinforcement and condition of base prior to arrival of inspector. For each placement Contractor will provide the Special Inspector with a written record of the quality control inspection performed by and signed by the Contractor.

C. Coordinate the installation of joint materials and vapor barriers with placement of forms and reinforcing steel.

D. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete", and as herein specified. Deposit concrete continuously or in layers of such thickness that concrete will not be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

F. 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 recommended practices.

G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion; limit duration of vibration to time necessary to consolidate without causing segregation of mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in proper position during concrete placement operations.

L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306, "Recommended Practice for Cold Weather Concreting" and as herein specified.

1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C, and not more than 80 degrees F (27 degrees C) at time of placement.

M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

N. Do not use calcium chloride, salt and other materials containing anti-freeze agents or chemical accelerators, unless otherwise accepted in mix designs.

O. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 "Recommended Practice for Hot Weather Concreting", and as herein stated.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing.

P. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Q. Wet forms thoroughly before placing concrete.

R. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 FINISH OF SURFACES:

A. Rough Form Finish (RfFm-Fn): For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish (SmFm-Fn): For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offset surfaces occurring 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 formed surfaces, unless otherwise indicated.

3. 8 MONOLITHIC SLAB FINISHES:

A. Floated Finish (Flt-Fn): Apply floated finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding and consolidating concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate surface with power driven floats, or by hand- floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10" when testing with a 10' straight edge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth granular texture.

B. Troweled Finish (Tr-Fn): Apply troweled finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling, with a steel trowel, when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8" in 10', except for concrete on metal deck shall not exceed 1/4" in 10' when testing with a 10' straight edge.

C. Light Broom Finish: Apply light broom finish to platforms, steps, landings, and for exterior or interior pedestrian ramps. After completion of float finishing, lightly draw broom over concrete surface and apply chemical-hardener finish at platform as specified above.

3.9 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by moist curing, by

1. Keep concrete surface continuously wet by covering with water.

2. Continuous water-Fog Spray.

   Surfaces shall be kept continuously moist for not less than 72 hours after finishing.

3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

   Surfaces shall be kept continuously moist for not less than 72 hours after finishing.

C. Provide moisture-cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

D. Provide membrane curing to slabs as follows:

1. Apply membrane-forming curing compound to concrete surfaces as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to Engineer.

E. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. IF FORMS ARE REMOVED, CONTINUE CURING BY METHODS SPECIFIED ABOVE AS APPLICABLE.

F. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.10 REMOVAL OF FORMS:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength of 28-days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

D. Early removal of formwork may be permitted as acceptable to the Engineer provided sufficient data is presented indicating that concrete has attained adequate strength and stiffness to resist anticipated loads without damage. Additional tests to determine early strength and stiffness shall be performed AT THE EXPENSE OF THE CONTRACTOR.

3.11 RE-USE OF FORMS:

A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surface, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.12 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete, but in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Before placing cement mortar or proprietary agent, brush-coat the area to be patched with neat cement grout or proprietary bonding agent.

C. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixtures and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surfaces.

D. Repair of formed Surfaces: Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

G. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

I. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.

J. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and brush with a neat cement grout, or apply concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

K. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout, or apply concrete bonding agent. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

L. Use epoxy-based mortar, approved by the Engineer, for structural repairs. Structural repairs include, but are not limited to, areas of unsound (honeycombed or spalled) concrete with a surface area greater than 9 square inches and/or with a depth greater than 1.5 inches, areas where reinforcement is exposed or areas with cracks greater than 1/16 inch in width. All areas requiring a structural patch shall be approved by the Engineer prior to commencing patching operations.

END OF SECTION 033000

SECTION 034150 - PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of structural precast concrete work is shown on drawings and in schedules.

B. Structural precast concrete includes the following:

Hollow slab units

1.3 RELATED WORK:

C. Cast-in-place concrete is specified in Division 3.

D. Joint sealants and backing are specified in Division 7.

E. Applied finishes are specified in Division 9.

1.4 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified. For the codes and standards listed in this section and in subsequent sections, follow the latest edition recognized by building authority having jurisdiction at the time of construction.

1. American Concrete Institute, (ACI 301), “Specifications for Structural concrete for Buildings.”

2. ACI-318, "Building Code Requirements for Reinforced Concrete."

3. Concrete Reinforcing Steel Institute, CRSI, "Manual of Standard Practice."

4. Pre-stressed Concrete Institute MNL 116, “Manual for Quality Control for Plants and Production of Precast Concrete Products.”

B. Fabricator Qualifications: Firms which have 2 years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.

Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.

C. Fabrication Qualifications: Produce precast concrete units at fabricating plant engaged primarily in manufacturing of similar units, unless plant fabrication or delivery to project site is impractical.

If units are not produced at precast concrete fabricating plant, maintain procedures and conditions for quality control which are equivalent to plant production.

D. Fire Resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire-resistance classification, provide units tested and listed by UL in “Fire Resistance Directory”, or with each unit bearing UL label and marking.

1.5 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer’s certifications and laboratory test reports as required.

B. Shop Drawings; Reinforcement: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

C. Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.

D. Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.

E. Include erection procedure for precast units and sequence of erection.

F. Provide complete design calculations prepared by a registered engineer, licensed in State where project is erected.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.

B. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

PART 2 - PRODUCTS

2.1 FORMWORK:

A. Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is nonreactive with concrete and will produce required finish surfaces.

B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.

Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

2.2 REINFORCING MATERIALS:

A. Reinforcing Bars (Rebar): ASTM A 6l5, Grade 60, unless otherwise indicated.

B. Welded Wire Fabric (WWF): ASTM A l85, welded steel wire fabric.

C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing complying with CRSI recommendations.

For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected CRSI, Class 1.

2.3 PRESTRESSING TENDONS:

A. Uncoated, 7-wire stress-relieved strand complying with ASTM A 416. Use Grade 250 unless Grade 270 indicated.

2.4 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I.

Use only one brand and type of cement throughout project, unless otherwise acceptable to Engineer.

B. Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

C. Lightweight Aggregate: ASTM C 330.

D. Water: Potable and free from foreign materials in amounts harmful to concrete and embedded steel.

E. Air-Entraining Admixture: ASTM C 260.

F. Water-Reducing Admixture: ASTM C 494, Type A.

2.5 CONNECTION MATERIALS:

A. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.

B. Steel Shapes: ASTM A 36.

C. Anchor Bolts: ASTM A 307, low-carbon steel bolts, regular hexagon nuts and carbon steel washers.

D. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inhibitive primer.

E. Bearing Pads: Provide bearing pads for precast concrete units as indicated on drawings.

F. Accessories: Provide clips, hangers, and other accessories required for installation of project units for support of subsequent construction or finishes.

2.6 GROUT MATERIALS:

A. Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 404. Mix at

ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

B. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

2.7 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type of concrete required. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option. Proportion mixes by either laboratory trail batch or field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 301 Section 3.9 "Proportioning on the Basis of Previous Field Experience or Trial Mixtures."

B. Produce normal-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties.

Compressive strength; 5000 psi minimum at 28 days. Release strength for prestressed units: 3500 psi.

C. Produce lightweight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:

Compressive strength; 5000 psi minimum of 28 days. Air-dry density; not less than 90 no more than 115 lbs. per cu. ft.

Release strength for prestressed units: 3500 psi.

Cure compression test cylinders using same methods as used for precast concrete work.

2.8 FABRICATION:

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, and as specified for types of units required.

B. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorage where they do not affect position of main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.

C. Cast-in holes for openings larger than 10" diameter or 10" square in accordance with final shop drawings. Other smaller holes will be field cut by trades requiring them, as acceptable to Engineer.

D. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formulation formcoating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

E. Clean reinforcement of loose rust and mill scale, earth and other materials which reduce or destroy bond with concrete.

F. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

G. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

H. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.

I. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage for reiforcement and built-in items.

J. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface which will not show in finished structure.

K. Curing by low-pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

L. Delay detensioning of prestressed units until concrete has attained at least 70% of design stress, as established by test cylinders.

If concrete has been heat-cured, perform detensioning while concrete is still warm and moist, to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.

Detensioning of pretensioned tendons may be accomplished either by gradual release of tensioning

jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

M. Finish of Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.

N. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth uniform finish.

Apply scratch finish to precast units which will receive concrete topping after installation. Following initial strikeoff, transversely scarity surface to provide ridges approximately ¼" deep.

2.9 HOLLOW SLAB UNITS:

A. Type: Precast prestressed concrete units with open voids running full length of slabs.

B. Furnish units which are free of voids or honeycomb, with straight true edges and surfaces.

C. Provide "Standard Finish" units unless otherwise indicated.

D. Fabrication: Manufacturer units of concrete materials which will provide a minimum 3500 psi compressive strength at time of initial prestress and 28-day compressive strength of 5000 psi.

Adequately reinforce slab units to resist transporting and handling stresses.

E. Include cast-in weld plates where required for anchorage or lateral bracing to structural steel members.

F. Cooperate with other trades for installation of items to be cast in hollow slab units. Notify Contractor of items not received in ample time so as not to delay work.

G. Provide solid, monolithic precast slab units indicated to be an integral part of hollow slab unit system. Design and fabricate solid units to dimensions and details indicated, s specified for hollow slab units.

H. Provide headers of cast-in-place concrete or structural steel shapes for openings larger than one slab

width in accordance with hollow slab unit manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL:

A. Bearing Pads: Install flexible bearing pads as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

B. Welding: Perform welding in compliance with AWS D 1.1, including qualification of welders.

C. Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.

D. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and compatible primer to painted surfaces.

E. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

F. Installation Tolerances: Install precast units without exceeding following tolerance limits.

1. Variations from Plumb: ¼" in any 20' run or story height, ½" total in any 40' or longer run.

2. Variations from Level or Elevation: ¼" in any 20' run; ½" in any 40' run; total plus or minus ½" at any location.

3. Variation from position in plan: Plus or minimum ½" maximum at any location.

4. Offsets in alignment and joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:

G. Grouting connections and joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:

Cement grout consisting of 1 part portland cement, 3.0 parts sand, and only enough water to properly mix and for hydration.

Shrinkage-resistant grout consisting of premixed compound and water to provide a flowable mixture

without segregation or bleeding.

Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

3.2 PLANT QUALITY CONTROL EVALUATIONS:

A. The Owner may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.

B. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits, will be subject to additional testing as herein specified.

Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.

D. Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions.

Failure to meet compressive strength tests requirements.

Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.

Concrete curing, and protection of precast units against extremes in temperature, not as specified.

Precast units damaged during handling and erection.

E. Testing Precast Units: When there is evidence that the strength of precast concrete units does not meet specification requirements for hardened concrete for compressive strength determination, complying

with ASTM C 42 and as follows.

Take at least 3 representative cores from precast units of suspect strength, from locations directed by Engineer.

Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet during use of completed structure.

Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% of 28-day design compressive strength.

Test results will be made in writing on same day that tests are made, with copies to Engineer, Contractor, and Precast Manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, name, and type of member or members represented by core test, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.

F. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

G. Defective work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section. Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

END OF SECTION 034150

SECTION 042000 - UNIT MASONRY

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. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Cavity wall insulation.

C. Related Requirements:

1. Section 044313 "Anchored Stone Masonry Veneer" for natural stone veneer.
2. Section 047200 “Cast Stone Masonry” for sills and lintels.
3. Section 051200 "Structural Steel Framing" structural steel components.
4. Section 072100 "Thermal Insulation" for cavity wall insulation.
5. Section 072725 “Fluid-Applied Membrane Air-Barriers”
6. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.6 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties and material test reports substantiating compliance with requirements.
b. For masonry units, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each type of exposed unit masonry construction in sizes approximately 48 inches long by 72 inches high by full thickness, including face and backup wythes and accessories.

    a. Include transitions, sills, flashings, etc. to demonstrate assemblies and workmanship.
2. Clean exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. 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.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD 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 of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. 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 spreading coverings 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.

D. 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 TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91/C 91M.

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. Cemex S.A.B. de C.V.
b. Essroc.
c. Holcim (US) Inc.
d. Lafarge North America Inc.
e. Lehigh Hanson; HeidelbergCement Group.

E. Mortar Cement: ASTM C 1329/C 1329M.

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. Lafarge North America Inc.

F. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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. BASF Corporation; Construction Systems.
b. Euclid Chemical Company (The); an RPM company.
c. GCP Applied Technologies Inc. (formerly Grace Construction Products).

I. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

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. Dur-O-Wal; a Hohmann & Barnard company.
b. Heckmann Building Products, Inc.
c. Hohmann & Barnard, Inc.
d. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 1/4-inch-diameter, hot-dip galvanized steel wire.

D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with a projecting vertical tab having a slotted hole for inserting wire tie.

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) FERO Corporation.
2) Hohmann & Barnard, Inc.

6. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section.

    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) Heckmann Building Products, Inc.
        2) Hohmann & Barnard, Inc.
        3) Wire-Bond.

7. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a sheet metal anchor section, 1-1/4 inches wide by 9 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 5-1/2 inches long, stamped into center to provide a slot between strap and base for inserting wire tie.

    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) Hohmann & Barnard, Inc.

8. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a sheet metal anchor section, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and base for inserting wire tie.

    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) Heckmann Building Products, Inc.
        2) Hohmann & Barnard, Inc.
        3) Wire-Bond.

9. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a gasketed sheet metal anchor section, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and base for inserting wire tie. Self-adhering, modified bituminous gasket fits behind anchor plate and extends beyond pronged legs.

    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) Hohmann & Barnard, Inc.
        2) Wire-Bond.

2.9 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

B. Extruded Polystyrene Board, Type IV, Drainage Panels: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; fabricated with shiplap or channel edges and with one side having grooved drainage channels.

C. Equivalent to Owens Corning; Foamular Insul-Drain, XPS Board, with filter fabric protection.

2.10 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

    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) Advanced Building Products Inc.
        2) Hohmann & Barnard, Inc.
        3) Wire-Bond.
        4) York Manufacturing, Inc.

2. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

    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) Advanced Building Products Inc.
        2) Hohmann & Barnard, Inc.
        3) Wire-Bond.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates. Coordinate compatibility of flashing materials with products specified in Section 072725 “Fluid-Applied Membrane Air-Barriers”.

C. Termination Bars for Flexible Flashing: Aluminum bars 1/8 inch by 1 inch.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vent Products: Use one of the following unless otherwise indicated:

1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.
2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

    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) Advanced Building Products Inc.
        2) Heckmann Building Products, Inc.
        3) Hohmann & Barnard, Inc.
        4) Wire-Bond.

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: 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. 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. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime, masonry cement or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
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.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. 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.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch. Maintain clear dimensions where noted or as required for Code compliance of clear widths and clear floor space.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch. Maintain clear dimensions where noted or as required for Code compliance of clear widths and clear floor space.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total. Maintain clear dimensions where noted or as required for Code compliance of clear widths and clear floor space.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a 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.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions to height indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.8 ANCHORING MASONRY TO CONCRETE

A. Anchor masonry to concrete, where masonry abuts or faces concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. 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.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide cast-stone and masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING AND WEEP HOLES

A. General: Install embedded flashing and weep holes in masonry at ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, and up face of sheathing at least 12 inches; with upper edge a minimum of 4 inches above the top of concrete foundation wall and lapped onto CMU wall. Fasten upper edge of flexible flashing to sheathing through termination bar. Fluid-applied membrane air-barrier to cover termination bar and lap onto flashing below bar a minimum of 4 inches.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes formed from plastic tubing 16 inches o.c.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. 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 that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

H. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.14 REPAIRING, POINTING, AND CLEANING

A. 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.

B. 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, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. 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 uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

SECTION 044313 - ANCHORED STONE MASONRY VENEER

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. Stone masonry anchored to unit masonry backup.

B. Products Installed but Not Furnished under This Section Include:

1. Steel lintels in unit masonry.
2. Cast-stone lintels.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for concealed flashing, horizontal joint reinforcement and veneer anchors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Samples for Initial Selection: For colored mortar and other items involving color selection.

C. Samples for Verification:

1. For each stone type indicated. Include at least three Samples in each set and show the full range of color and other visual characteristics in completed Work.
2. For each color of mortar required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

C. Material Test Reports:

1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous five years.
2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for each type of stone masonry in sizes approximately 60 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.

a. Include cast-stone water table at top of mockup.
b. Include a sealant-filled joint at least 16 inches long in mockup.
c. Include 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 stone masonry above half of flashing).

2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.

1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

C. 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 stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. 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 seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.10 COORDINATION

A. Advise installers of adjacent Work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

B. Coordinate locations of dovetail slots installed in concrete that are to receive stone anchors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain each variety of stone from single quarry with resources to provide materials of consistent quality in appearance and physical properties.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

C. Varieties and Sources: Subject to compliance with requirements, provide stone of varieties and from sources complying with Section 044200 "Exterior Stone Cladding."

2.2 RUBBLE STONE VENEER

A. Material Standards:

1. Maximum Absorption per ASTM C 97/C 97M: 7.5 percent.
2. Minimum Compressive Strength per ASTM C 170/C 170M: 4000 psi.

B. Varieties and Sources: Subject to compliance with requirements, available stone varieties that may be incorporated into the Work include, but are not limited to, the following:

1. New England Small and Medium Round Cobble (4 inches to 6 inches), as supplied by O&G Industries; 260 Murphy Road, Hartford, CT 06114 or a comparable product supplied by another stone supplier.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

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. Essroc.
b. Holcim (US) Inc.
c. Lafarge North America Inc.
d. Lehigh Hanson; HeidelbergCement Group.

D. Mortar Cement: ASTM C 1329/C 1329M.

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. Lafarge North America Inc.

E. Masonry Cement: ASTM C 91/C 91M.

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. Cemex S.A.B. de C.V.
b. Essroc.
c. Holcim (US) Inc.
d. Lafarge North America Inc.
e. Lehigh Hanson; HeidelbergCement Group.

F. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
2. White Aggregates: Natural white sand or ground white stone.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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. Euclid Chemical Company (The); an RPM company.
b. GCP Applied Technologies Inc. (formerly Grace Construction Products).
c. Sonneborn.

H. Water: Potable.

2.4 VENEER ANCHORS

A. Materials:

1. As specified in Section 04200 “Unit Masonry Accessories”.

2.5 EMBEDDED FLASHING MATERIALS

A. As specified in Section 04200 “Unit Masonry Accessories”.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Weep/Vent Products: As specified in Section 04200 “Unit Masonry Accessories”.

2.7 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

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. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

2.8 FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.

C. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Thickness: 4 inches minimum and 6 inches maximum. Thickness does not include projection of pitched faces.

D. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.

1. Finish: Natural Rubble Stone.

2.9 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.
2. Use portland cement-lime, masonry cement or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
4. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding 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 one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.

1. Mortar for Setting Stone: Type N or Type S.
2. Mortar for Pointing Stone: Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.

B. Examine substrate to verify that reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING STONE MASONRY

A. Perform necessary field cutting and trimming as stone is set.

1. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
2. Pitch face at field-split edges as needed to match stones that are not field split.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones in uncoursed rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.

D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

E. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.

F. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

G. Install lintels where indicated. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

H. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 3/8 inch at narrowest points or more than 1 inch at widest points.

I. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.
2. Sealant joints are specified in Section 079200 "Joint Sealants."

J. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.

K. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. As specified in Section 04200 “Unit Masonry Accessories”.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control

joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

B. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.

E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

A. Anchor stone masonry to unit masonry with adjustable, screw-attached veneer anchors unless as specified in Section 04200 “Unit Masonry Accessories”.

B. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.

C. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.

D. Fill space between back of stone masonry and drainage materials with mortar as stone is set.

E. Rake out joints for pointing with mortar to depth of not less than 3/4 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Concave.

3.7 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry 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 cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.

3.8 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

END OF SECTION 044313

SECTION 047200 - CAST STONE MASONRY

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. Cast-stone trim, including the following:

a. Window sills.
b. Lintels.
c. Water tables.

B. Related Sections:

1. Section 042000 "Unit Masonry" for installing cast-stone units in unit masonry.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For colored mortar.

D. Samples for Verification:

1. For each color and texture of cast stone required, 10 inches square in size.
2. For each trim shape required, 10 inches in length.
3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

E. Full-Size Samples: For each color, texture and shape of cast-stone unit required.

1. Make available for Architect's review at Project site or at manufacturing plant, if acceptable to Architect.
2. Make Samples from materials to be used for units used on Project immediately before beginning production of units for Project.
3. Approved Samples may be installed in the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast-stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast-stone units if required, using dollies with wood supports.
2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.2 CAST-STONE MATERIALS

A. General: Comply with ASTM C 1364.

B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33/C 33M; gradation and colors as needed to produce required cast-stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33/C 33M, gradation and colors as needed to produce required cast-stone textures and colors.

E. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.

3. Air-Entraining Admixture: ASTM C 260/C 260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast-stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from steel complying with ASTM A 36 and hot-dip galvanized to comply with ASTM A 123.

2.3 CAST-STONE UNITS

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. Heritage Cast Stone, Kansas City, MO
2. Oldcastle Precast Rotondo, Avon, CT
3. Plasticrete, Rex Precast Systems, Cheshire, CT

B. Cast-Stone Units: Comply with ASTM C 1364.

1. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

    a. No fewer than five days at mean daily temperature of 70 deg F or above.
    b. No fewer than six days at mean daily temperature of 60 deg F or above.
    c. No fewer than seven days at mean daily temperature of 50 deg F or above.
    d. No fewer than eight days at mean daily temperature of 45 deg F or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Colors and Textures:

1. Lintels: Hammered finish in color selected by Architect from manufacturer's full range.
2. Sills: Smooth finish in color selected by Architect from manufacturer’s full range. Color will match lintels.
3. Water Table: Smooth finish in color selected by Architect from manufacturer’s full range. Color will match lintels.

2.4 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 042000 "Unit Masonry."

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from steel complying with ASTM A 36 and hot-dip galvanized to comply with ASTM A 123.

B. Dowels: 1/2-inch- diameter round bars, fabricated from steel complying with ASTM A 36 and hot-dip galvanized to comply with ASTM A 123.

C. Proprietary Acidic Cleaner: 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 cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

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. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

2.6 MORTAR MIXES

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

2.7 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C 1364.

1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast-stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 1/4 to 3/8 inch wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.

I. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."

1. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

J. Provide sealant joints at expansion, control, and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work specified in this section.

1.2 SUMMARY:

A. Extent of structural steel work is shown on Drawings, including schedules, notes, details and type of steel required.

B. Structural steel is that work defined in American Institute of Steel Construction, AISC 303, "Code of Standard Practice for Steel Buildings and Bridges" and as otherwise shown on Drawings.

C. Related work is specified elsewhere.

1.3 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified. For the codes and standards listed in this section and in subsequent sections, follow the latest edition recognized by building authority having jurisdiction at the time of construction:

1. AISC 303 "Code of Standard Practice for Steel Buildings and Bridges"

2. AISC 360 "Specifications for Structural Steel Buildings

3. RCSC's "Specifications for Structural Joints using High-Strength Bolts"

4. AISC 341 "Seismic Provisions for Structural Steel Buildings"

5. American Welding Society, AWS, D1.1 "Structural Welding Code".

6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

7. ASTM A 123 "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."

8. American Hot Dip Galvanizers Association, "Inspection Manual for Hot Dip Galvanized Steel Products".

B. Fabricator Qualifications: Fabricator must have a minimum of 5 years successful experience in the fabrication of structural steel framing components similar, in nature, to those required for this project. In addition, the fabricator shall have a quality control program acceptable to the Engineer.

C. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC–Certified Erector.

D. Qualifications for Welding Work: Qualify procedures and personnel according to AWS D.1/D1.1M "Structural Welding Code-Steel."

Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within previous 12 months.

1. If recertification of welders is required, retesting will be Contractor's responsibility.

E. Special Inspection: The Owner will engage the services of a qualified “Special Inspector” for this project. The Special Inspector, as a representative of the Owner, will confirm that the provisions of Chapter 17 of the International Building Code are complied with and will provide and/or supervise inspection and testing requirements, as necessary.

F. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

G. Steel fabricator shall be subject to Special Inspection requirements of the Building Code for fabrication plants and as defined in Part A and Part B below.

Part A Inspection – Verification of Capability and Quality Control: The Special Inspector will confirm that the structural steel fabricating plant has the personnel, organization, knowledge, experience, procedures, equipment, capability, and commitment to produce fabricated structural steel of the required quality of the category of structural steel work involved in the project. The basis of inspection will be the AISC manual “Quality Criteria and Inspection Standards”.

A structural steel fabricator that is Certified in Category II under the AISC Quality Certification Program may be exempted from Part A.

Part B Inspection – Verification of Implementation: The Special Inspector will confirm the implementation of the design by inspecting the fabrication of structural steel load bearing connections, members or assemblies in the shop to ensure conformance with the design plans, approved shop drawings and project specifications. Inspection shall consist of one or more of the following: Observation, interviews, testing, and/or examination of records.

H. The Special Inspector will inspect high-strength bolted connections and welded connections, perform tests, examine steel for straightness and alignment, fissures, mill scale, and other defects and deformities as described in ASTM A6, examine fabricated pieces for conformity with approved shop drawings including member sizes and prepare test reports as required.

Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

I. The Contractor shall furnish such facilities and provide such assistance as may be required for carrying out the inspection prescribed herein. He shall notify the inspection agency at least two weeks in advance of the start of any qualification testing or welding.

J. The Special Inspector will perform his duties, insofar as possible, in such a way that neither fabrication nor erection is unnecessarily delayed or impeded.

Field inspection will include examination of erected steel for welding, proper fitting, tensioning of bolts, alignment, trueness and plumbness.

K. Contractor shall correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Additional tests will be performed at contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

L. Shop Welding will be inspected and tested during fabrication of structural steel assemblies, as follows:

1. Verify welder certification and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

2. The inspection agency will test shop welds as follows:

   All welds: 100% visual according to AWS D1.1/D1.M and the following inspection procedures, at testing agency's option:

   1. Liquid Penetrant Inspection: ASTM E165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

   All moment connection full penetration welds: 20% (50% if fabricator is not certified by AISC) ultrasonic conforming to ASTM E164.

      a) Inspection level: If more than 10 percent of the welds are rejected then an additional 20 percent of the welds shall be tested. If 10 percent of these additional welds are found to be rejectable then an additional 20% of all full penetration welds will be tested. If 10 percent of this group is rejected

then 100% of the welds will be tested.

N. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360 degree flash or welding repairs to any shear connector.

2. Conduct tests according to requirement in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

O. Field bolted connections will be inspected to confirm compliance to Sections 2, 3 and 8 of AISC "Specification for Structural Joints Using High-Strength Bolts". Observe calibration procedures for calibration devices used on the project and monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is properly used to tighten all bolts.

1. Visually inspect all bolted connections to verify that connection is fully compacted.

P. Field Welding will be inspected and tested during erection of structural steel as follows:

1. Verify welder certification and conduct inspection and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

2. The inspection agency will test field welds as follows:

   All welds: 100% visual.

   All moment connection full penetration welds: 100% ultrasonic conforming to ASTM E164.

3. Comply with AWS D1.1/D1.1M for tolerances, appearances, welding, procedure specifications, weld quality, and methods used in correcting welding work.

4. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections and removal of paint on surfaces adjacent to field welds.

5. Remove backing bars or runoff tabs where indicated, back gauge and grind steel smooth.

6. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

Q. For weld tests, reports by the Agency inspector will contain, as a minimum, an adequate description

of each weld tested, the identifying mark of the welder responsible for the weld, a critique of statement regarding the acceptability of the weld tested, as judged by current A.W.S. Standards.

1.4 SUBMITTALS:

A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. High-strength bolts (each type), including nuts and washers.

2. Shrinkage-resistant grout.

B. Shop Drawings: Submit shop drawings (in electronic form) including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

1. Include details of cuts, connections, splices, camber, holes and other pertinent data.

2. Include embedment drawings.

3. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical, high-strength bolted connections.

C. Welding Procedure Specifications (WPS's) and Procedure Qualification Records (PQR's): Provide according to AWS D1.1/D1.1M, "Structural Welding Code-Steel," for each welded joint, whether prequalified or qualified by testing, including the following:

1. Power Source (constant current of constant voltage).
2. Electrode Manufacturer and trade name, for demand critical welds.

D. Delegated Design Submittal: For structural steel connections indicated to comply with design loads, include analysis data signed & sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data for Installer, Fabricator, Testing Agencies.

F. Welding Certificates.

G. Mill test reports for structural steel including chemical and physical properties.

H. Product Test Reports for the following:

1. Bolts, nuts and washers, including mechanical properties and chemical analysis.
2. Nonshrink grout.

I. Survey of existing conditions.

J. Source and Field quality-control reports.

K. Special Inspection Reports.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

C. For galvanized materials comply with ASTM A 123.

D. Store fasteners in a protected place, in sealed containers with manufactures labels intact.

1. Fasteners may be repackaged provided Owner’s testing and inspecting agency observes repackaging and seal containers.

2. Clean and re-lubricate bolts and nuts that become dry and rusty before use.

3. Comply with manufacturer’s written recommendations for cleaning and lubricating ASTM F 1852 Fasteners and for retesting fasteners after re-lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicted and comply with other information and restrictions indicated.

2.2 MATERIALS:

A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

B. W-Shapes: ASTM A 992

C. Channels, Angles: ASTM A36

D. Structural Steel, Plates and Bars: ASTM A 36 or ASTM A 572 Grade 50 or ASTM A529, as indicated on the Drawings.

E. Cold Formed Hollow Structural Sections: ASTM A500, Grade B.

F. Material for galvanizing shall be geometrically suitable for galvanizing as specified in ASTM A 384 and A 385.

G. Anchor Bolts: ASTM F 1554, unheaded type unless otherwise indicated on the Drawings.

H. High-Strength Bolts, Nuts and Washers: ASTM A325 or A490, Type 1, heavy–hex steel structural bolts.

I. Unfinished Threaded Fasteners: ASTM A36, regular low-carbon steel bolts and nuts.

1. Provide hexagonal heads and nuts for all connections.

J. High-Strength Threaded Fasteners: Heavy hexagon structural "tension control" bolts, heavy hexagon nuts, hardened washers as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.

K. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 through 1020 cold finished carbon steel; with dimensions complying with AISC specifications.

L. Electrodes for Welding: Comply with AWS Code.

M. Non-Metallic Non-Shrink Grout: Premixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with ASTM C1107 and suitable to be placed for 30-minute working time.

N. Zinc for Galvanizing: As specified in ASTM A123.

O. Primer:

1. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services). "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers".

2. Primer Fabricators standard lead and chromate-free, nonasphaltic, rust-inhabiting primer complying with MPI #79 and compatible with topcoat.

3. Galvanizing Repair Paint: Comply with ASTM A780.

2.3 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

1. Camber Structural Steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
4. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

2. Thermal cutting in the field is not permitted without written consent from the engineers.

C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

D. Connections: Weld or bolt shop connection, as indicated.

E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

F. Web Penetrations: Not Permitted.

2.3 SHOP PRIMING:

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistant materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommend by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

C. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Priming Systems", to provide a dry thickness of not less than 1.5 mils.

2.4 GALVANIZING:

A. Apply Zinc coating by hot-dip process to structural steel members, fabrications, and assemblies according to ASTM A 123.

B. Safeguard against steel embrittlement in conformance with ASTM A 143.

C. Safeguard against warpage or distortion of steel members to conform with ASTM A 384. Notify Architect/Engineer of potential warpage problems which may require modification in design, before proceeding with steel fabrications.

D. Bolts, nuts, and washers, and iron and steel hardware components to be galvanized in accordance with ASTM A 153. Nuts to be tapped after galvanizing to minimum diametral amounts specified in ASTM A 563. Coat nuts with waterproof lubricant, clean and dry to touch. High strength bolts for structural steel joints to be galvanized in accordance with ASTM A 325.

PART 3 - EXECUTION:

3.1 INSPECTION:

A. Erector must examine areas and conditions under which structural steel work is to be installed, and notify Contractor in writing of conditions detrimental to proper and timely completion of work.

3.2 ERECTION:

A. Surveys: Employ a registered land surveyor to establish permanent bench marks as shown and as necessary for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Engineer.

B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide guy lines to achieve proper alignment of structures as erection proceeds. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

D. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

1. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

E. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

F. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

G. Pack non-shrink grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure.

1. For proprietary grout materials, comply with manufacturer's instructions.

H. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure within specified AISC tolerances. Adjust and weld in final position all structural steel angles which support architectural finish material. Adjustments are to be made to the tolerances of the applied finish materials.

2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

3. Splice members only where indicated and accepted on shop drawings.

I. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

J. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

K. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in structural

framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Engineer. Finish gas cut sections equal to a sheared appearance when permitted.

L. Do not use thermal cutting during erection.

M. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same material as used for shop painting.

N. Touch-Up Galvanized Surfaces: Repair damaged galvanized surfaces in accordance with ASTM A 780. Dry film thickness of applied repair materials to be not less than galvanized coating thickness required by ASTM A 123 or A 153, as applicable. Touch up prime-painted surfaces with same galvanized primer applied in shop. Clean damaged surfaces first to assure proper paint adhesion.

END OF SECTION 051200

SECTION 05500 - 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 SUMMARY

A. This Section includes the following:

1. Loose bearing and leveling plates.
2. Loose steel lintels.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Miscellaneous metal trim.

B. Related Sections include the following:

1. Division 5 Section “Pipe Hangers and Supports for Swimming Pool Piping”.
2. Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings and for railing infill panels.
3. Division 6 Section "Miscellaneous Rough Carpentry" for metal framing anchors and other rough hardware.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Manufactured products.
2. Paint products.
3. Grout.

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. 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.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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 construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- wide slotted holes in webs at 2 inches o.c.

1. Width of Channels: 1-5/8 inches.
2. Depth of Channels: 1-5/8 inches.
4. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating; 0.079-inch nominal thickness.
5. Finish: Hot-dip galvanized after fabrication.

E. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 ALUMINUM

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.

2.4 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FASTENERS

A. General: Provide Type 304 stainless-steel fasteners for exterior use where indicated and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls or where indicated. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A ; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6..

E. Lag Bolts: ASME B18.2.1.

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5 for interior use.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594 for exterior use.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.6 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. 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. Shear and punch metals cleanly and accurately. Remove burrs.

C. 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.

D. 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. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. 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.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up 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.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.8 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports indicated and as necessary to complete the Work.

B. Fabricate units from structural-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.

1. Fabricate units from slotted channel framing where necessary.
2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
3. Furnish inserts if units must be installed after concrete is placed.

C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness, unless otherwise indicated.

1. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

D. Galvanize miscellaneous framing and supports where indicated.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry

construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior.
2. Interior, where indicated.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.14 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.15 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated (Mill) Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

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. 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.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 SETTING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink, nonmetallic, grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.

3.4 INSTALLING PREMANUFACTURED PRODUCTS

A. General: Install in accordance with manufacturer’s written recommendations and instructions.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055050 - HANGERS AND SUPPORTS FOR SWIMMING POOL PIPING

PART 1 GENERAL

1.1 SUMMARY

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the pipe hanger and supports as described in this specification.

1.2 REFERENCES

A. ASTM International:

1. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
2. ASTM A653 – Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process
3. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability *(Formerly ASTM A570)*

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SUBMITTALS

A. Submit product data on all hanger and support devices, including shields and attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

1.4 QUALITY ASSURANCE

A. Steel pipe hangers and supports shall have the manufacturer’s name, part number, and applicable size stamped in the part itself for identification.

B. Hangers and supports shall be designed and manufactured in conformance with MSS SP 58.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years of documented experience, and with service facilities within 50 miles of Project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with these specifications, wire basket cable tray systems to be installed shall be as manufactured by the following:

1. Basis of Design: Cooper B-Line. 509 West Monroe Street, Highland, IL, 62249, USA. Phone:(618) 654-2184 or email blineus@cooperindustries.com
2. Architect approved equivalent

2.2 PIPE HANGERS AND SUPPORTS

A. Hangers

1. Uninsulated pipes 2 inch and smaller:
   a. Adjustable steel swivel ring (band type) hanger, B-Line B3170.
   b. Adjustable steel swivel J-hanger, B-Line B3690.
   c. Malleable iron ring hanger, B-Line B3198R or hinged ring hanger, B3198H.
   d. Malleable iron split-ring hanger with eye socket, B-Line B3173 with B3222.
   e. Adjustable steel clevis hanger, B-Line B3104 or B3100.

2. Uninsulated pipes 2-1/2 inch and larger:
   a. Adjustable steel clevis hanger, B-Line B3100.
   b. Pipe roll with sockets, B-Line B3114.
   c. Adjustable steel yoke pipe roll, B-Line B3110.

B. Pipe Clamps

1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200. For insulated lines use double bolted pipe clamps, B-Line B3144 or B3146 with B3200.

C. Multiple or Trapeze Hanger

1. Trapeze hangers shall be constructed from 12 gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8 inch minimum, B-Line B22 strut or stronger as required.
2. Mount pipes to trapeze with 2 piece pipe straps sized for outside diameter of pipe, B-Line B2000 Series.
3. For pipes subjected to axial movement:
   a. Strut mounted roller support, B-Line B3126. Use pipe protection shield or saddles on insulated lines.
   b. Strut mounted pipe guide, B-Line B2417.

D. Wall Supports

1. Pipes 4 inch and smaller:
   a. Carbon steel hook, B-Line B3191.
   b. Carbon steel J-hanger, B-Line B3690.
2. Pipes larger than 4 inch:
   a. Welded strut bracket and pipe straps, B-Line B3064 and B2000 series.
   b. Welded steel brackets, B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll. B-Line B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

E. Floor Supports

1. All Piping:
   a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line B3093 and B3088T or B3090 and B3088. Pipe saddle shall be screwed or welded to appropriate base stand.

F. Vertical Supports

1. Steel riser clamp sized to fit outside diameter of pipe, B-Line B3373.

G. Copper Tubing Supports

1. Hangers shall be sized to fit copper tubing outside diameters.

   a. Adjustable steel swivel ring (band type) hanger, B-Line B3170CT.
   b. Malleable iron ring hanger, B-Line B3198RCT or hinged ring hanger B3198HCT.
   c. Malleable iron split-ring hanger with eye socket, B-Line B3173CT with B3222.

d. Adjustable steel clevis hanger, B-Line B3104CT.

2. For supporting vertical runs use epoxy painted or plastic coated riser clamps, B-Line B3373CT or B3373CTC.
3. For supporting copper tube to strut use epoxy painted pipe straps sized for copper tubing, B-Line B2000 series, or plastic inserted vibration isolation clamps, B-Line BVT series.

H. Thin Wall Plastic and Flexible Tubing Supports:

1. V-Bottom clevis hanger with galvanized 18-gauge continuous support channel, B-Line B3106 and B3106V, to form a continuous support system for plastic pipe or flexible tubing.

I. Supplementary Structural Supports

1. Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Channels shall be roll formed, 12 gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to engineer for approval. Use clamps and fittings designed for use with the

2.3 UPPER ATTACHMENTS

A. Concrete Inserts

1. Post installed concrete inserts in accordance with manufacturer's requirements and as required to support anticipated loads.

2.4 ACCESSORIES

A. Hanger Rods shall be threaded either ends, or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

B. Shields shall be 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.

C. Pipe protection saddles shall be formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a center support rib.

2.5 FINISHES

A. Non-submerged Applications: Hangers, anchors and strut shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.

B. Submerged Applications (Surge Tank and Backwash Pits): Hangers and strut shall be type 304 stainless steel with stainless steel hardware.

PART 3 EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

A. Pipe shall be adequately supported by pipe hanger and supports specified in PART 2 PRODUCTS.

B. Horizontal steel piping shall be supported in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

NOMINAL PIPE SIZE (INCHES)	ROD DIAMETER (INCHES)	MAXIMUM SPACING (FEET)
1/2 to 1-1/4	3/8	7
1-1/2	3/8	9
2	3/8	10
2-1/2	1/2	11
3	1/2	12
3-1/2	1/2	13
4	5/8	14
5	5/8	16
6	3/4	17
8	3/4	19
10	7/8	22
12	7/8	23
14	1	25
16	1	27

C. Horizontal copper tubing shall be supported in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

NOMINAL PIPE SIZE (INCHES)	ROD DIAMETER (INCHES)	MAXIMUM SPACING (FEET)
1/2 to 3/4	3/8	5
1	3/8	6
1-1/4	3/8	7
1-1/2	3/8	8
2	3/8	8
2-1/2	1/2	9
3	1/2	10
3-1/2	1/2	11
4	1/2	12
5	1/2	13
6	5/8	14
8	3/4	16

D. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non adhesive isolation tape- B-Line Iso-pipe. Galvanized felt isolators sized for copper tubing may also be used, B-Line B3195CT.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.

G. Place a hanger within 12 inches of each horizontal elbow.

H. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every [other] floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

I. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified in section 2.02 C. Trapeze hangers shall be spaced according to the smallest pipe size, or install intermediate supports according to schedule in section 3.01B.

J. Do not support piping from other pipes, ductwork or other equipment that is not building structure.

3.2 CONCRETE INSERTS

A. Provide post-installed anchors for existing concrete surfaces.

END OF SECTION 055050

SECTION 055213 - PIPE AND TUBE RAILINGS

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. Steel pipe and tube railings.
2. Hot-dip galvanizing and factory-applied architectural finish for railings.

1.3 COORDINATION

A. Coordinate installation of anchorages for railings. 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. Coordination between Fabricator and Galvanizer: Prior to fabrication and final submittal of shop drawings to Landscape Architect, direct fabricators to submit shop drawings to the galvanizer for all metal fabrications to receive factory-applied metal coatings. Direct galvanizer to review fabricator's shop drawings for suitability of materials for galvanizing and coatings and coordinate any required modifications to fabrications required to be performed by the fabricator.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Railing brackets.
2. Grout, anchoring cement, and paint products.
3. Product Literature for Factory-Applied Metal Coatings: Submit galvanizer’s product literature for coatings specified in this Section including test data.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1. Initial Selection and Verification Samples of Factory-Applied Metal Coatings: Submit two 3 inch by 6 inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.

2. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters. Provide examples of welds, bends and mitered corners.
3. Fittings and brackets.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Certificate of Compliance for Items Coated by Galvanizer: If requested, submit notarized Certificate of Compliance with application for payment for galvanizing, signed by the galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed.

C. Certificate of Compliance for Shop Drawing Review by Galvanizer: If requested, submit galvanizer's certification that shop drawings for metal fabrications to receive metal coatings have been reviewed and that fabrications are acceptable to galvanizer for proper application of galvanizing and metal coatings. All drawings shall be signed by the galvanizer to indicate acceptance of design for galvanizing.

D. Certificate of Compliance of Item Identification by Galvanizer: The galvanizer shall mark all lots of material with a clearly visible tag indicating the name of the galvanizer, the type and weight of the coating, and the applicable ASTM standards. If requested, submit certification of compliance that items have been tagged.

E. Certificate of Compliance for Shop Application: Galvanizer/applicator shall supply a certificate of compliance with SSPC-QP3 – Certification Standard for Shop Application of Complex Protective Coating Systems.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Galvanizer’ Qualifications: Engage the services of a qualified galvanizer who has demonstrated a minimum of ten years experience in the successful application of galvanized coatings specified in this specification in the facility where the work is to be performed and who will apply the coatings within the same facility.

C. Coating Applicator’s Qualifications: Galvanizing and factory-applied coatings shall be performed by a company with a minimum of ten years experience in the successful application of hot-dip galvanizing utilizing the dry kettle process.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.9 WARRANTY

A. Provide hot-dip galvanizer's warranty for coatings that fail in materials or workmanship within specified warranty period. Failures include hot-dipped galvanized process with 10 percent or more visible rust and finish failing to meet the performance specifications referenced in Article 2.7 STEEL AND IRON FINISHES below.

B. Warranty Period:

1. Galvanizing Process: 20 years.
2. Finish: 5 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

C. 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 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

A. General: Provide the following:

1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
5. Weld joint to match weld “Type 1” of the National Ornamental & Miscellaneous Metals Association (NOMMA) voluntary joint finish standards.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

J. Form Changes in Direction as Follows:

1. As detailed.
2. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. 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 (6 mm) or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.7 STEEL AND IRON FINISHES

A. Coating Applicator: Subject to compliance with requirements, provide factory-applied metal coatings by Duncan Galvanizing, 69 Norman Street, Everett, MA, 02149, (617) 389-8440, www.duncangalvanizing.com.

B. Hot-Dip Galvanized Railings: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coatings for iron and steel fabrications applied by the hot-dip process. Galvanizing bath shall contain special high grade zinc and other earthly materials.

1. Basis-of-Design: Duragalv by Duncan Galvanizing.
2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
3. Provide thickness of galvanizing specified in referenced standards.
4. Fill vent holes after galvanizing, if applicable, and grind smooth.
5. Galvanizing shall exhibit a rugosity (smoothness) 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. Factory-Applied Architectural Finish Over Galvanized Steel: Provide factory-applied architectural coating over hot-dip galvanized steel matching approved samples.

1. Basis-of-Design: Colorgalv by Duncan Galvanizing.

    a. Color: to be selected by Landscape Architect from coating manufacturer's full range. Color to be similar to existing metal finish on building columns and panels.

2. Primer coat shall be factory-applied polyamide epoxy primer. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment

meeting applicable environmental regulations and as recommended by the primer coating manufacturer.

3. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer.
4. Coatings shall be certified OTC/VOC compliant and conform to applicable regulations and EPA standards.
5. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
6. Clean galvanized surface to create an acceptable profile for coatings. Galvanizer shall certify that performance will be met without blast cleaning and coating will be applied within 12 hours of galvanizing at the galvanizer's plant. If blasted, galvanizer shall certify that rugosity standards are met.
7. Primer shall meet or exceed the following performance criteria:

    a. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load) 1 kg load, 200 mg loss.
    b. Adhesion: ASTM D 4541, 1050 psi.
    c. Corrosion Weathering: ASTM D 5894, 13 cycles, 4,368 hours, 10 per ASTM D 714 for blistering; 7 per ASTM D 610 for rusting.
    d. Direct Impact Resistance: ASTM D 2794, 160 in. lbs.
    e. Flexibility: ASTM D 522, 180 degrees bend, 1 inch mandrel, Passes.
    f. Pencil Hardness: ASTM D 3363, 3H.
    g. Moisture Condensation Resistance: ASTM D 4585, 100 degrees F, 2000 hours, Passes no cracking or delamination.
    h. Dry Heat Resistance: ASTM D 2485, 250 degrees F.
    i. Accelerated Weathering: QUV- ASTM D 4587 QUV A 5000 Hours: Passes.
    j. Salt Fog Resistance: ASTM B 117, 5,600 hours No cracking or blisters.

8. Topcoat shall meet or exceed the following performance criteria:

    a. Abrasion Resistance: ASTM D 4060, CS17 Wheel, 1,000 cycles 1 kg load, 87.1 mg loss.
    b. Adhesion: ASTM D 4541, 1050 psi.
    c. Direct Impact Resistance: ASTM D 2794, greater than 28 in. pounds.
    d. Dry Heat Resistance: ASTM D 2485, 200 degrees F (93 C).
    e. Salt Fog Resistance: ASTM B 117 9,000 hours, Rating 10 per ASTM D 714 for blistering, Rating 9 per ASTM D 610 for rusting.
    f. Flexibility: ASTM D522, 180 degrees bend, 1/8 inch mandrel, Passes.
    g. Pencil Hardness: ASTM D 3363, F.
    h. Moisture Condensation Resistance: ASTM D 4585, 100 degrees F, 1000 hours, No blistering or delamination.
    i. Xenon Arc Test: ASTM D 4798, Pass 200 hours.
    j. Corrosion Weathering: ASTM D 5894, 21 Cycles, 7056 Hours: Rating 10 per ASTM D714 for blistering. Rating 9 Per ASTM D 610 for Rusting.
    k. Thermal Shock: ASTM D 2246, 15 cycles, Excellent.

9. Topcoat shall exhibit a rugosity (smoothness) 4 rug or less (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

F. Comply with fabricator’s and galvanizer’s requirements for installation of materials and fabrications, including the use of nylon slings or padded cables for handling factory-coated materials.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.3 APPLICATION OF FACTORY-APPLIED METAL COATINGS

A. Galvanizing Application: Galvanize materials in accordance with specified standards and this specification. Galvanizing shall provide an acceptable substrate for applied coatings. The dry kettle process shall be used to eliminate any flux inclusions on the surface of the galvanized material.

B. Prior to galvanizing, the steel shall be immersed in a pre-flux solution (zinc ammonium chloride). The pre-flux tank must be 12 to 14 Baumé density and contain less than 0.4 percent iron. Use of the wet kettle process is not acceptable. To provide the galvanized surface required, the following procedures shall be implemented:

1. A monitoring recorder shall be utilized and inspected regularly to observe any variances in the galvanizing bath temperature.
2. The pickling tanks shall contain hydrochloric acid with an iron content less than 8 percent and zinc content less than 3 percent. Titrations shall be taken weekly at a minimum.
3. All chemicals and zinc shall be tested at least once a week to determine compliance with ASTM standards. All testing shall be done using atomic absorption spectrometry or x-ray fluorescence (XRF) equipment at a lab in the galvanizing plant.

C. Finish coatings shall be applied under the following conditions.

1. Minimum air temperature shall be 65 degrees F. Surface temperature of steel shall be 60 degrees to 95 degrees F and, in any event, be 5 degrees F higher than the dew point. Humidity shall be 85 percent maximum.
2. The use of iron or steel shot and sand and aluminum oxide grit as a blast medium, and power wire brushes are not permitted.
3. Surface of substrate shall be dry and free from dust, dirt, oil, grease or other contaminants. Coating and cure facility shall be maintained free of airborne dust and dirt until coatings are completely cured.

3.4 ANCHORING POSTS

A. Form or core-drill holes to depth indicated on Drawings and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

3.5 ADJUSTING AND CLEANING

A. Touch-Up and Repair: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.

1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Galvanizing repair paint shall have 95 percent zinc by weight, ZiRP by Duncan Galvanizing. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel for warranties to apply. Touch-up shall be such that repair is not visible from a distance of 6 feet. If non factory-approved technicians are used for field touch-up, no warranties shall exist.

3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 055220 – STAINLESS STEEL PIPE AND TUBE RAILINGS

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. Stainless-steel pipe and tube railings.

B. Related Requirements:

1. Section 13150 "Swimming Pool Systems and Equipment" for stainless steel tube railings associated with the swimming pool ladders.
2. Section 13150 “Swimming Pool Systems and Equipment for anchors for stainless steel railings in swimming pool.

1.3 COORDINATION

A. Coordinate installation of anchorages for railings. 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. Schedule installation so attachments are made only to completed structures. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

D. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

E. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stainless-Steel Pipe and Tube Railings:

1. Blum, Julius & Co., Inc.
2. Paragon Aquatics
3. Tubular Specialties Manufacturing
4. Wagner, R&B, Inc.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.4 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade T 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

2.5 FASTENERS

A. General: Provide the following:

1. Stainless-Steel Railings: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

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.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. 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.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings as continuous bent rails to the extent possible. Where not possible provide with welded connections.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form Changes in Direction as Follows:

1. By radius bends

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Provide inserts and other anchorage devices for connecting railings to concrete. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

L. At swimming pool railings, provide factory installed means of bonding to grounding system.

M. Site Railing Sleeves: For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

N. Swimming Pool Railing Sleeves: Sleeves at swimming pool shall have bronze anchors as specified in Section 131500 “Swimming Pool Systems and Equipment”.

2.8 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines, or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches.

C. 320-Grit Polished and buffed Finish: Oil-ground, uniform, fine, directionally textured finish.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Site Railings: Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with escutcheon of same metal as post, attached to post with set screws.

C. Install removable railing sections at swimming pool, in slip-fit metal sockets cast in concrete, as specified in Section 131500 “Swimming Pool Systems and Equipment”.

3.4 ADJUSTING AND CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.5 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061000 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work specified in this section.

1.2 SUMMARY:

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Sheathing.
5. Wood blocking cants and nailers.
6. Wood furring and grounds.

B. Related Requirements:

Section 061800 “Glued Laminate Construction”.

1.3 DEFINITIONS:

A. Rough Carpentry: Carpentry work not specified in other sections and not exposed, unless otherwise indicated.

B. Exposed Framing: Framing not concealed by other construction.

C. Boards: Lumber of 2 inches nominal in thickness and 2 inches nominal or greater in width.

D. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

E. Timber: Lumber of 5 inches nominal or greater in least dimension.

F. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers’ Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.

5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS:

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment for chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project Site.

5. Include copies of warranties from chemical treatment manufactures for each type of treatment.

B. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

2. For Preservative-Treated Wood Products: Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

C. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.

5. Power-driven fasteners.
6. Powder-actuated fasteners.
7. Expansion anchors.
8. Metal framing anchors.

1.5 QUALITY ASSURANCE:

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material Bering the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber form weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship.”

1. Dimension lumber framing.
2. Timber.
3. Laminated-veneer lumber.
2. Parallel-strand lumber.
3. Prefabricated wood I-joists.
4. Rim boards.
5. Sheathing.
6. Miscellaneous lumber

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and

provide certificates of grade compliance issued by grading agency.

3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dresses sizes for dry lumber.

4. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

D. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE –TREATED LUMBER:

A. Preservative Treatment by Pressure Process: AWPA U1; Use category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

2. For exposed items indicated to receive a stained or natural finish, use chemical formulation that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates or treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.

5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS:

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test—response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not cause corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.

3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent [Kiln-dry plywood after treatment to maximum moisture content of 15 percent].

D. Identify fire-retardant-treatment wood with appropriate classification marking of qualified testing

agency.

1. For exposed lumber indicated to receive a stained or naturel finish, omit marking and provide certificates of treatment compliance issued by testing agency.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings and the following:

1. Framing for raised platforms.
2. Framing for stages.
3. Concealed blocking.
4. Framing for non-load-bearing partitions.
5. Framing for non-load-bearing exterior walls.
6. Roof construction.
7. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING:

A. General: Dimension Lumber of grades and species indicated on Drawings according to the American Lumber Standards Committee National Grading Rule Provisions of the Grading Agency indicated.

2.5 ENGINEERED WOOD PRODUCTS:

A. Engineered Wood Products, General: Products shall contain no urea formaldehyde. 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. Source Limitations: Obtain each type of engineered wood product form single source from a single manufacturer.

C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. Sizes, spacing and design properties indicated on drawings unless otherwise indicated.

D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior –type adhesive complying with ASTM D 2559.

1. Sizes, spacing and design properties indicated on drawings unless otherwise indicated.

E. SHEATHING

1. Plywood: DOC PS 1.
2. Oriented Strand Board: DOC PS 2.
3. Thickness: As needed to comply with requirements specified but not less than thickness indicated on Drawings.
4. Comply with “Code Plus” provisions in APA Form No. E30K, “APA Design/Construction Guide: Residential & Commercial.”
5. Factory mark panels according to indicated standard.

2.6 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide the following species:

1. Mixed southern pine; SPID for exposed conditions.

2. Douglas Fir-Larch WCLIB or WWPA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB for exposed conditions.

2. Douglas Fir Larch No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged fire- retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch nominal thickness.

1. Plywood 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".

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacturer.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: AMSE B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M), Property Class 4.6); with ASTM A 563 hex nuts and where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F594, Alloy Group 1 or 2.

2.9 METAL CONNECTION HARDWARE

A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:

1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.

2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

C. Stainless Steel Sheet: ASTM A 666, [Type 304] [Type 316].

1. Use for exterior locations and where indicated.

D. Joist and Rafter Hangers, Post Base and Caps, Holdown Anchors, Straps, Hurricane Ties and Framing Clips as indicated on Drawings.

2.10 MISCELLANEOUS MATERIALS:

A. Sill-Sealer Gaskets: Glass-fiber-resilient installation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch, selected from manufacturer's standard widths to suit width of sill members indicted.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam ¼ inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

D. Adhesives for Field Gluing Structural Panels to Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

E. Adhesives for Gluing furring and sleepers to Concrete or masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesives 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."

F. Water-Repellant Preservative: NWWDA-tested and accepted formulation containing 3 –iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL:

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF & PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacture's written instructions.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Install sill sealer gasket to form continues seal between sill plates and foundation walls.

G. Do not splice structural members between supports unless otherwise indicated.

H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing of blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for times that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.

K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NEs NER-272 for power-driven fasteners.

2. Table 2304.9.1, “Fastening Schedule,” in ICC’s International Building Code.

3. Table R602.3(1), “Fastener Schedule for Structural Members,” and Table R602.3(2), “Alternate Attachments,” in ICC’s International Residential Code for One- and Two-Family Dwellings.

4. Published requirements of metal connection hardware manufacturer.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable.
2. Use finishing nails otherwise indicated. Countersink nail heads and fill holes with wood filler.

3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD GROUND SLEEPER, BLOCKING, AND NAILER INSTALLATION:

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1 – ½ inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.4 WALL AND PARTITION FRAMING INSTALLATION:

A. General: Arrange studs so wide face of stud is perpendicular to direction of wall or partition and narrow face is parallel. Provide single bottom plate and double top plates using members of 2 – inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide studs as sized and spaced as indicated on drawings.

2. For interior partitions and walls, provide 2-by-4-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.

3. Provide continuous horizontal blocking as 4’-0” using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width unless otherwise indicated.

2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb stud for wider openings. Provide headers of depth indicated on drawings.

3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION:

A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal size or 2-by-4-inch nominal size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers.

C. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 TIMBER FRAMING INSTALLATION

A. Install timber with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous embers unless otherwise indicated; tie together over supports as indicated if not continuous.

B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide ½ - inch air space at sides and ends of wood members.

C. Install wood posts using metal anchors indicated.

D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellant preservative for 15 minutes.

3.9 PROTECTION:

A. Protect wood that has been treated with inorganic boron (SBX) form weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA –registered label.

B. Protect rough carpentry from weather.
C. END OF SECTION 061000

SECTION 061216 STRUCTURAL INSULATED PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural insulated panels (SIPs) with polyurethane core.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

B. Section 06 11 16 - Mechanically Graded Lumber.

C. Section 34 11 33 - Timber Track Cross Ties.

D. Section 06 20 13 - Exterior Finish Carpentry.

1.3 REFERENCES

A. ASTM International:
1. ASTM C 203 - Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
2. ASTM C 272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
3. ASTM C 273 - Standard Test Method for Shear Properties of Sandwich Core Materials.
4. ASTM C 297 - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions.
5. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM D 1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
7. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
8. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
9. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
10. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. Underwriters Laboratories, Inc: UL 723 - Test for Surface Burning Characteristics of Building Materials

C. The Engineered Wood Association: APA PRP-108 - Performance Standards and Qualification Policies for Structural-Use Panels.

1.4 SUBMITTALS

A. Submit under provisions of Section 013000.

B. Product Data: Manufacturer's data sheets on each product; manufacturer-specific installation instructions for SIP system, including preparation instructions and recommendations, and storage and handling requirements and recommendations.

C. Shop Drawings: Submit shop drawings for SIPs showing layout, elevations, SIP details, product components and accessories. SIP installation drawing shall be reviewed by and sealed by a registered professional engineer qualified to perform such work. Deviations from standard detail and load design values shall be calculated and signed and sealed by a registered professional engineer.

D. Samples: Submit 12 inch by 12 inch (305 mm by 305 mm) sample panel.

E. SIP Code Compliance Report: Submit manufacturer's ICC-ES evaluation report for the International Building Code.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be experienced in performing work of this section and shall specialize in installation of work similar to that required for this project. All work shall be performed in accordance with the manufacturer's installation manuals, and in accordance with manufacturer's panel layout drawings when supplied.

B. Source Limitations: Obtain all SIPs from one manufacturer, through one source. Accessories shall be acceptable to the SIP manufacturer.

C. Field Measurements: Provide field measurements of structure to SIPs manufacturer prior to fabrication of panels. Coordinate fabrication schedule to comply with project schedule requirements.

D. Low-Emitting Materials - Composite Wood and Agrifiber: Provide composite wood products used in the panel system that contain no added urea-formaldehyde resins.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Erect panels in area designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Correct mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with SIP manufacturer ordering instructions and coordinate lead time requirements to avoid construction delays.

B. Delivery: Deliver materials from SIP manufacturer with identification labels or markings intact.

C. Unloading: Off-load SIPs from delivery vehicle using method which will not damage SIPs, and as acceptable to the manufacturer.

D. Storage: SIPS shall be fully supported using wood stickers, placed in level storage, and

prevented from contact with the ground. Stickers shall be placed as recommended by manufacturer.

E. Protection: SIPs shall remain in the manufacturer's protective wrap until needed for installation. Unused panels will be rewrapped and/or covered with a suitable covering that will prevent exposure to rain, snow, water, sunlight, dirt, mud, and any foreign matter that may affect SIP performance.

F. Subsequent Construction: Coordinate installation of subsequent construction to avoid exposure of SIPs to rain, snow, high moisture, and ultraviolet light and as recommended by the manufacturer.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer to the greatest extent practical. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Panel manufacturer will provide lamination warranty documents for building Owner acceptance and execution upon completion. Manufacturer's standard forms shall be submitted.

PART 2 PRODUCTS

2.1 MANUFACTURERS

1) Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by Murus Company (The), which is located at: P. O. Box 220 3234 Rt. 549 ; Mansfield, PA 16933; Toll Free Tel: 800-626-8787 ; Tel: 570-549-2100; Email: request info (info@murus.com); Web: www.murus.com, or comparable product by one of the following:

a. Extreme Panel Technologies, 475 East 4th Street North, P.O. Box 435, Cottonwood, MN 56229 - ph: 800-997-2635
b. Insulspan / GLI, 9012 East US 223, P.O. Box 38, Blissfield, Michigan 49228, ph: 517-486-4844
c. Foard Panel, P.O. Box 185, West Chesterfield, NH 03466; ph. 800-644-8885

B. Requests for substitutions will be considered in accordance with provisions of Section 016000.

2.2 STRUCTURAL INSULATED PANELS

A. Murus Polyurethane Structural Insulated Panel (SIP) with Polyurethane Core: A stress skin panel manufactured using the proprietary manufacturing method of Uniform Dispersion Molding (UDM) complying with the following:

1. Panel Type: MURUS CLAD-2100PUR Structural Insulated Panel, OSB/PUR Foam Core/OSB/Pine Cladding.

2. Thermal Characteristics: 4-5/8 inches (117 mm) thick SIP with R-27.

3. Thermal Characteristics: 5-5/8 inches (143 mm) thick SIP with R-34.
4. Thermal Characteristics: 6-5/8 inches (168 mm) thick SIP with R-41.

5. Polyurethane Closed Cell Foam: Minimum of 2.2 pcf (35 kg/cu m) insulation meeting manufacturers quality standards and the following:
   a. K Factor (aged foam): .145, ASTM C 518.
   b. Compressive Strength: 23 psi, ASTM D 1621.
   c. Compressive MOE: 682 psi, ASTM D 1621.
   d. Shear Strength: 31 psi, ASTM C 273.
   e. Shear Modulus: 203 psi, ASTM C 273.
   f. Flexure MOR: 52 psi, ASTM C 203.
   g. Flexure Modulus (MD): 587 psi, ASTM C 203.
   h. Tensile Strength: 37 psi, ASTM D 1623.
   i. Tensile Modulus: 611 psi, ASTM D 1623.
   j. WVT/Perm Inches: 1.0, ASTM E 96.
   k. Foam Fire Rating: Class 1, UL723.
   l. Flame Spread: 20, UL723.
   m. Smoke Developed: 300, UL723.
   n. Transverse Load: ASTM E 72.
   o. Combined Axial and Bending: ASTM E 72.
6. OSB: APA performance rating mark shall be identified on the panel, with an Exposure 1 durability rating; minimum physical properties shall be tested and described in APA PRP-108 or NIST PS 2. 7/16 inch (11 mm) thickness unless noted otherwise.
7. Cam Locks: If indicated or required, shall be installed in the panel during the manufacturing process.
8. Wiring Chases: If indicated or required, shall be formed into the panel during the manufacturing process.
9. Sizes: As indicated; Murus polyurethane SIPs are available in sizes from 4 feet by 4 feet to 4 feet by 24 feet (1219 mm by 1219 mm to 1219 mm by 7315 mm).

2.3 ACCESSORIES

A. Fasteners: Galvanized ring shank panel nails, or panel screws, as specified by panel manufacturer, for attachment of panel to frames, roofs, and corners. All fasteners to be sized and provided by manufacturer and installed per manufacturer's requirements. Do not use common fasteners.

B. Foam Sealant: Compatible with all components of the panel and adjacent materials, provided by manufacturer.

C. Construction Adhesive for Installing Dimensional Lumber: Supplied by contractor, acceptable to manufacturer.

D. Dimensional Lumber: SPF #2 kiln-dried or better, or pre-engineered equivalent.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until supporting structures have been properly prepared.

B. If supporting framing and level line are the responsibility of another installer, notify

Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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. Installation shall be in strict accordance with manufacturer's published instructions, details, and the drawings that are part of the contract documents for this project. Conflicts between these documents shall be resolved in writing prior to start of construction.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. When storing panels, do not allow them to come into contact with the ground. Stored panels shall remain dry and in the manufacturer's original packaging. Do not allow panels to be stored in an unsupported manner.

C. Roof panels shall be fully protected from weather by roofing materials or other means to provide temporary protection at the end of the day, or when rain or snow is imminent.

D. Remove and replace insulated wall or roof panels which have become excessively wet or damaged before proceeding with installation of additional panels or other work.

END OF SECTION

SECTION 061533 – COMPOSITE WOOD DECKING

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. Composite Wood (Plastic) decking.
2. Support framing for elevated decks.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for support framing for elevated decks.

1.3 DEFINITIONS

A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Timber: Lumber of 5 inches nominal or greater in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For plastic decking.

1. For plastic decking. Include installation instructions.

B. Samples: For plastic decking, not less than 24 inches long, showing the range of variation to be expected in appearance of decking, including surface texture.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Plastic decking.
2. Decking fasteners.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Handle and store plastic lumber to comply with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PLASTIC DECKING

A. Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.

1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, shall not be less than design loads and spans indicated.

B. Composite Plastic Lumber: Solid or hollow shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.

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. AZEK Building Products, Inc.
b. CertainTeed Corporation.
c. Trex Company, Inc.

2. Decking Standard: ICC-ES AC109 or ICC-ES AC174.
3. Decking Size: 7/8 by 5-1/2 inches actual.
4. Surface Texture: Manufacturer's standard.
5. Color: As selected by Architect from manufacturer's full range.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Use stainless steel unless otherwise indicated.

B. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.

C. Install plastic lumber to comply with manufacturer's written instructions.

D. Secure decking to framing with screws.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

END OF SECTION 061533

SECTION 061850 - GLUED-LAMINATED CONSTRUCTION

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 framing using structural glued-laminated timber.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with structural glued-laminated timber.

1.3 DEFINITIONS:

A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

1.4 SUBMITTALS:

A. Product Data: For each type of product.

1. Include data on lumber, adhesives, fabrication, and protection.

2. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

3. For connectors. Include installation instructions.

B. Shop Drawings:

1. Show layout of structural glued-laminated timber system and full dimensions of each member.

2. Indicate species and laminating combination.

3. Include large-scale details of connections.

4. Delegated-Design Submittal: For structural glued-laminated timber and timber connectors

C. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glued-laminated timber including variations due to specified treatment.

1. Apply specified factory finish to three sides of half length of each Sample.

D. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.

E. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.

F. Research/Evaluation Reports: For structural glued-laminated timber and timber connectors, from ICC-ES.

1.5 QUALITY ASSURANCE:

A. Manufacturer Qualifications: An AITC or APA-EWS-licensed firm.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. General: Comply with provisions in AITC 111.

B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. Structural Performance: Structural glued-laminated timber and connectors shall withstand the effects of structural loads shown on Drawings without exceeding allowable design working stresses listed in AITC 117 or determined according to ASTM D 3737 and acceptable to engineer of record.

B. Seismic Performance: Structural glued-laminated timber and connectors shall withstand the effects of earthquake motions determined according to ASCE 7.

2.2 STRUCTURAL GLUED-LAMINATED TIMBER:

A. General: Provide structural glued-laminated timber that complies with AITC A190.1 and AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.

1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.

2. Provide structural glued-laminated timber made from single species.

3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.

4. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.

5. Adhesive shall not contain urea-formaldehyde resins.

6. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Regional Materials: Glued-laminated timber shall be manufactured within 500 miles of Project site from wood that has been harvested and milled within 500 miles of Project site.

C. Certified Wood: Glued-laminated timber shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

D. Species and Grades for Structural Glued-Laminated Timber: As indicated on drawings shall comply with "Performance Requirements" Article.

E. Species and Grades for Structural Glued-Laminated Timber: Douglas fir-larch, Southern pine that complies with structural properties indicated on drawings.

F. Appearance Grade: Architectural, complying with AITC 110.

1. For Premium and Architectural appearance grades, fill voids as required by AITC 110.[**For Premium appearance grade, use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch wide.**]

2.3 PRESERVATIVE TREATMENT:

A. Preservative Treatment: Where preservative-treated structural glued-laminated timber is indicated, comply with AWPA U1, Use [**Category 1**] [**Category 2**] [**Category 3A**] [**Category 3B**] [**Category 4A**].

1. Use preservative solution without water repellents or substances that might interfere with application of indicated finishes.

2. Do not incise structural glued-laminated timber or wood used to produce structural glued-laminated timber.

B. Preservative:[**One of the following:**]

1. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
2. Pentachlorophenol in light petroleum solvent.
3. Copper naphthenate in a light petroleum solvent.
4. Ammoniacal zinc copper arsenate (ACZA) in a water solution.
5. Chromated copper arsenate (CCA) in a water solution.
6. Ammoniacal copper quat Type A (ACQ-C) in a water solution.
7. Propiconazole tebuconazole imidacloprid (PTI) in a water emulsion.

C. After dressing members, apply a copper naphthenate field-treatment preservative to comply with AWPA M4 to surfaces cut to a depth of more than 1/16 inch.

2.4 TIMBER CONNECTORS:

A. General: Unless otherwise indicated, fabricate from the following materials.

B. Fabricate beam seats from steel with 3/8-inch bearing plates, 3/4-inch- diameter-by-12-inch- long deformed bar anchors, and 0.239-inch side plates.

C. Fabricate beam hangers from steel with 0.179-inch stirrups and 0.239-inch top plates.

D. Fabricate hinge connectors from steel with 0.179-inch side plates and [3/4-inch] [1-inch] top and bottom plates.

E. Fabricate strap ties from steel, 3 inches wide by 0.239 inch thick.

F. Provide bolts, 3/4 inch unless otherwise indicated, complying with ASTM A 307, Grade A; nuts complying with ASTM A 563; and, where indicated, flat washers.

G. Provide shear plates complying with ASTM D 5933.

H. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.

2. Round steel bars complying with ASTM A 575, Grade M 1020.

3. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.

I. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123 or ASTM A 15.

2.5 MISCELLANEOUS MATERIALS:

A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

C. Sealers shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FABRICATION:

A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

1. Dress exposed surfaces as needed to remove planing and surfacing marks.

B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.

C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.

1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

D. End-Cut Sealing: Immediately after end cutting each member to final length and after preservative treatment, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.

E. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit except for preservative-treated wood where treatment included a water repellent.

2.7 FACTORY FINISHING:

A. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew and fungus.

B. Finishing materials shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.

B. Framing Built into Masonry: Provide 1/2-inch clearance at tops, sides, and ends of members built into masonry; bevel cut ends 3 inches ; and do not embed more than 4 inches unless otherwise indicated.

C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

D. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.

1. Predrill for fasteners using timber connectors as templates.

2. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

3. Coat cross cuts with end sealer.

4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.

a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

E. Install timber connectors as indicated.

1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
2. Install bolts with orientation as indicated or, if not indicated, as directed by Engineer of Record.

3.3 ADJUSTING:

A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

3.4 PROTECTION:

A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.

1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.
2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION 061850

SECTION 062023 – FINISH 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 SUMMARY

A. This Section includes the following:

1. Exterior cellular PVC trim.
2. Exterior plywood paneling.
3. Interior plywood paneling.
4. Interior wood and cellular PVC trim.

B. Related Sections include the following:

1. Division 6 Section "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for structural wood decking and framing exposed to view.
2. Division 6 Section “Exterior Finish Carpentry” for exterior carpentry exposed to view.
3. Division 9 Section "Painting" for finishing of finish carpentry.

1.3 DEFINITIONS

A. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NHLA - National Hardwood Lumber Association.
3. NLGA - National Lumber Grades Authority.
4. RIS - Redwood Inspection Service.
5. SCMA - Southern Cypress Manufacturers Association.
6. SPIB - Southern Pine Inspection Bureau.
7. WCLIB - West Coast Lumber Inspection Bureau.
8. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.

B. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 12 by 12 inches (203 by 250 mm) for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 12 by 12 inches for panels.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Softwood Plywood: DOC PS 1.

2.2 MDO PLYWOOD PANELING

A. Medium Density Overlay (MDO) Plywood Paneling: Overlay surface, exposed sides only. Made with binder containing no urea-formaldehyde resin.

B. Color to be manufacturer's standard "wood tone" color.

C. 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:

1. Loisiana Pacific
2. Weyerhauser
3. Georgia Pacific

D. Properties:

1. Thickness: 5/8" or as indicated.
2. Finish: Overlay
3. Product: APA Trademarked, B-B, Group 1
4. Panel Sizes: As indicated.

2.3 CELLULAR PVC TRIM

A. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, recommended by manufacturer for exterior use, made from UV- and heat-stabilized, rigid material.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corporation; CertainTeed Restoration Millwork.
b. Kleer Lumber, LLC; Kleer Trimboard.
c. Vycom Corp.; Azek.

2. Density: Not less than 31 lb/cu. ft..
3. Heat Deflection Temperature: Not less than 130 deg F, according to ASTM D 648.
4. Coefficient of Thermal Expansion: Not more than 4.5 x 10^{-5} inches/inch x deg F.
5. Water Absorption: Not more than 1 percent, according to ASTM D 570.
6. Flame-Spread Index: 75 or less, according to ASTM E 84.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails.
2. For pressure-preservative-treated wood, provide stainless-steel fasteners.
3. For applications not otherwise indicated, provide stainless steel or hot-dip galvanized-steel fasteners.

4. For exposed fasteners, provide stainless steel.

B. Fasteners for Interior Finish Carpentry: Nails, screws, lag screws and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

1. Provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.

C. Paneling Adhesives: Comply with paneling manufacturer's written recommendations for adhesives.

D. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for materials required for sealing siding work.

2.4 FABRICATION

A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.

B. Back out or kerf backs of the following members, except members with ends exposed in finished work:

1. Exterior standing and running trim wider than 5 inches.
2. Interior standing and running trim, except shoe and crown molds.

C. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

3.4 PANELING INSTALLATION

A. MDO Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Install with uniform joints between panels as detailed.

1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as detailed.
2. Conceal fasteners where not detailed to be exposed.

3.5 ADJUSTING

A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 062023

SECTION 071616 - CRYSTALLINE 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 SUMMARY

A. This Section includes crystalline waterproofing.

B. Related Sections include the following:

1. Division 3 Sections "Cast-in-Place Concrete" and “Concrete Waterstops” for formwork, waterstops, and finishing concrete walls and slabs to receive waterproofing.
2. Division 7 Section "Joint Sealants" for elastomeric and preformed sealants in concrete and masonry walls and floors.

1.3 SUBMITTALS

A. Product Data: Include construction details, and material descriptions and installation instructions for crystalline waterproofing.

B. Product Certificates: For crystalline waterproofing, signed by product manufacturer.

C. Qualification Data: For Installer and manufacturer.

D. Material Test Reports: For crystalline waterproofing.

E. Manufacturer's inspection reports of completed installation.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Mockups: Provide mockups of crystalline waterproofing to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Architect will select locations of mockups that represent typical surfaces and conditions for applications of crystalline waterproofing.

a. Vertical and Horizontal Surfaces, including one inside corner and one outside corner: Provide samples of at least 10 sq. ft.. Locate mockup at backwash holding tank. Acceptable surfaces may be used in the completed work.

2. Apply waterproofing according to requirements for the completed Work after permanent lighting and other environmental services have been activated.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to crystalline waterproofing including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review required certifying procedures.

1.5 PROJECT CONDITIONS

A. Proceed with waterproofing work only after pipe sleeves, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

B. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agrees to repair or replace components of crystalline waterproofing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to maintain watertight conditions within specified warranty period.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Crystalline Waterproofing:

    a. AQUAFIN, Inc.; Aquafin-1C.
    b. Specon, Incorporated; Hydrocel (HCPM).
    c. Tamms Industries, Inc.; Hey'Di K-11.
    d. ThoRoc, Div. of ChemRex; Tegraproof.
    e. Zypex, Concentrate, White

2. Plugging and Patching for Leak Repair (Product as recommended by Manufacturer for actual conditions):

    a. AQUAFIN, Inc.; Fix 10-S or Mortar-1C.
    b. Specon, Incorporated; Hydrocel (HCMM).
    c. Tamms Industries, Inc.; Hey'Di Powder-X System.
    d. ThoRoc, Div. of ChemRex; Tegraproof mortar.
    e. Zypex, Patch n' Plug, Megamix II

2.2 MATERIALS

A. Crystalline Waterproofing: A prepackaged, white-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates by capillary action into concrete or masonry and reacts chemically with free lime in the presence of water to develop crystalline growth within concrete or masonry capillaries to produce an impervious, dense, waterproof concrete or masonry with properties meeting or exceeding the following criteria:

1. Permeability: 0 for water at 33 feet when tested according to CE CRD-C 48.
2. Compressive Strength: 3000 psi when tested according to ASTM C 109/C 109M.

B. Patching Compound: Cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections; with properties meeting or exceeding the following criteria:

1. Compressive Strength: 7600 psi at 28 days when tested according to ASTM C 109/C 109M.
2. Flexural Strength: 710 psi at 28 days when tested according to ASTM C 348.
3. Shrinkage: Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.

C. Plugging Compound: Cementitious compound with hydrophobic properties; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic); with properties meeting or exceeding the following criteria:

1. Permeability: 30 feet when tested according to CE CRD-C 48.
2. Compressive Strength: 6000 psi at 28 days when tested according to ASTM C 109/C 109M.
3. Flexural Strength: 1000 psi at 28 days when tested according to ASTM C 348.
4. Bond Strength: 300 psi at 14 days when tested according to ASTM C 321.

D. Water: Potable.

2.3 PROPORTION AND DESIGN OF PROTECTIVE TOPPING MIX

A. Protective Topping: Measure, batch, and mix portland cement and sand in the proportion of 1:3 and water. Blend together with mechanical mixer to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions: Examine substrates, with Applicator present, where waterproofing is to be applied.

1. Proceed with application only after unsatisfactory conditions have been corrected.
2. Notify Architect in writing of active leaks or structural defects that would affect system performance.

3.2 PREPARATION

A. Protect other work from damage from cleaning, preparation, and application of crystalline waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.

B. Stop active water leaks according to waterproofing manufacturer's written instructions.

C. Repair damaged or unsatisfactory concrete or masonry according to manufacturer's written instructions.

D. Surface Preparation:
1. Brush Blast or Sand Blast concrete surfaces to receive crystalline waterproofing and comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents that may be on surfaces following preparation and before installation of waterproofing, to ensure that waterproofing bonds to concrete or masonry surfaces.

2. Clean masonry surfaces according to ASTM D 4261.

a. Lightweight Concrete Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
b. Medium- and Normal-Weight Concrete Masonry: Sandblast or bushhammer to a depth of 1/16 inch.

3. Clean concrete surfaces according to ASTM D 4258.

a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.

4. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

A. General: Comply with waterproofing manufacturer's written instructions for application.

1. Dampen surface with water and maintain damp condition until applying waterproofing.
2. Apply waterproofing to inside surfaces of surge tank and backwash holding tank, including walls, floor and surge tank ceiling/beam.
3. Number of Coats: Two
4. Dampen surface between coats.

B. Final Coat Finish: Smooth.

C. Moist-cure waterproofing for three days immediately after application has set, followed by two days of air drying as recommended in writing by manufacturer.

D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:

1. Onto beams and columns integral with treated walls and ceilings.
2. Onto every substrate in areas indicated for treatment, including pits and sumps and similar offsets and features.

3.4 PROTECTION

A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than three days by procedures recommended in writing by waterproofing manufacturer. Protect waterproofing from temperatures below 36 deg F.

3.5 FIELD QUALITY CONTROL

A. Inspection: Manufacturer's representative to inspect completed application and to provide a written report that application complies with manufacturer's written instructions.

END OF SECTION 071616

SECTION 072500 - WEATHER BARRIERS

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. Building wrap.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Building Innovations: E. I. du Pont de Nemours and Company; Tyvek CommercialWrap or a comparable product by one of the following:

a. Dow Chemical Company (The).
b. Kingspan Insulation Limited.
c. Raven Industries, Inc.

2. Water-Vapor Transmission: 23 perms and 163 g/m^2-24 hours ASTM E 96 (Method A).
3. Air Penetration Resistance: 0.001 cfm/sq. ft. at 1.57 psf when tested according to ASTM E 2178.
4. Allowable UV Exposure Time: Not less than three months.
5. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 072500

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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. Vapor-permeable, fluid-applied air barriers.

B. Related Requirements:

1. Section 072500 "Weather Barriers" for weather barriers, including building wraps with air-barrier properties.

1.3 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to

discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont Building Innovations: E. I. du Pont de Nemours and Company ; DuPont Tyvek Fluid Applied WB. or a comparable product by one of the following:

    a. 3M Industrial Adhesives and Tapes Division.
    b. GE Construction Sealants; Momentive Performance Materials Inc.
    c. Hohmann & Barnard, Inc.
    d. Pecora Corporation.
    e. W. R. Meadows, Inc.

2. Physical and Performance Properties:

    a. Air Permeance: Maximum 0.002 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
    b. Vapor Permeance: Minimum 10 perms; ASTM E 96, Desiccant Method, Procedure A.
    c. Ultimate Elongation: Minimum 400 percent; ASTM D 412, Die C.
    d. Adhesion to Substrate: Minimum 33 lbf/sq. in. when tested according to ASTM D 4541.
    e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
    f. UV Resistance: Can be exposed to sunlight for 9 months according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

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. Dow Corning Corporation.
b. GE Construction Sealants; Momentive Performance Materials Inc.
c. Pecora Corporation.
d. Tremco Incorporated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of building assemblies and base flashing to ensure continuity of air barrier.
2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
3. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

C. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

D. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

E. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

F. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

G. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.

H. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.

6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to[ASTM E 783 or ASTM E 2357.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

E. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074113 - STANDING-SEAM METAL ROOF PANELS

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 standing-seam metal roof panels.

B. Related Sections:

1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.
2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations 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.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Integral-Standing-Seam Metal Roof Panels: Formed with integral ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and interconnecting side edges of adjacent panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company ; Berridge Cee-Lock. or a comparable product by one of the following:

a. ATAS International, Inc.
b. Petersen Aluminum Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel

sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 22-gauge.
b. Exterior Finish: Two-coat fluoropolymer.
c. Color: As selected by Architect from manufacturer's full range.

3. Clips: One-piece fixed to accommodate thermal movement.

a. Material: 22 gauge nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

4. Panel Coverage: 16 inches.
5. Panel Height: 1.0 inch.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

3. 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. Carlisle Residential; a division of Carlisle Construction Materials.
b. GCP Applied Technologies Inc. (formerly Grace Construction Products).
c. Henry Company.
d. Owens Corning.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets.

E. Panel Fasteners: Self-tapping screws designed to withstand design loads.

F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply full covderage of roof, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113

SECTION 074646 - FIBER-CEMENT SIDING

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 fiber-cement siding.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 062013 "Finish Carpentry" for exterior cellular PVC trim.
3. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For fiber-cement siding including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- long-by-actual-width Sample of siding.
2. 24-inch- wide-by-36-inch- high Sample panel of siding assembled on plywood backing.
3. 12-inch- long-by-actual-width Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement siding.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.7 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. Furnish full lengths of fiber-cement siding including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Building Products, Inc.; HardiePlank Lap Siding, Smooth or a comparable product by one of the following:

    a. CertainTeed Corporation.
    b. GAF Materials Corporation.

B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Horizontal Pattern: Boards 5-1/4 inches wide in plain style.

1. Texture: Smooth.

E. Factory Priming: Manufacturer's standard acrylic primer.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: High-performance organic finish.

C. Fasteners:

1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening fiber cement, use hot-dip galvanized fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Install fasteners no more than 16 inches o.c.

B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

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. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
2. Roof insulation.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood carpentry, nailers, curbs, and blocking and for wood-based, structural-use roof deck panels.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 221423 "Roof Drains" for roof drains in EPDM Roofing.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacings and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.

2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, roofing accessories and other components of roofing system.
2. Warranty Period: 15 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation, for roofing system from manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following wind loading:

1. Basic Wind speed (3 second gust): 95 mph
2. Wind Exposure category: B
3. Wind Pressure: 25 psf

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 EPDM ROOFING

A. EPDM: ASTM D 4637, Type I, nonreinforced, uniform, flexible EPDM sheet.

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. Carlisle SynTec Incorporated.
b. Firestone Building Products.
c. GAF.
d. Johns Manville; a Berkshire Hathaway company.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: Black.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55- to 60-mil-thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Bonding Adhesive: Manufacturer's standard, water based.

E. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

F. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

G. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.

H. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film.

I. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

K. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

L. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

M. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

1. Provide white flashing accessories for white EPDM membrane roofing.

2.5 SUBSTRATE BOARDS

A. Substrate Board: Refer to Section 061000 “Rough Carpentry”.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle SynTec Incorporated.
b. Firestone Building Products.
c. GAF.
d. Johns Manville; a Berkshire Hathaway company.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread spray-applied, low-rise, two-component urethane adhesive.

2.8 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D 312, Type III or Type IV.

B. Asphalt Primer: ASTM D 41/D 41M.

2.9 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
5. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft., and allow primer to dry.
2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
3. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
4. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roofing.

F. Fabric-Backed Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roofing.

G. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.

H. Apply roofing with side laps shingled with slope of roof deck where possible.

I. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

1. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

J. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

K. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

L. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

M. Adhere protection sheet over membrane roofing at locations indicated.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
2. Flood each area for 24 hours.
3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.10 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: City of New Britain
2. Address: .
3. Building Name/Type: AW Stanley Park Bathhouse.
4. Address: 2100 Stanley Street, New Britain, CT.
5. Acceptance Date: _____.
6. Warranty Period: 15 Years.
7. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. lightning;
b. peak gust wind speed exceeding 95 mph;
c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075323

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Formed low-slope roof sheet metal fabrications.
2. Formed steep-slope roof sheet metal fabrications.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 074113 “Standing Seam Metal Roof Panels” for materials and installation of sheet metal flashing and trim integral with roofing.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.

5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

3. 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. Carlisle Residential; a division of Carlisle Construction Materials.
    b. GCP Applied Technologies Inc. (formerly Grace Construction Products).
    c. Henry Company.
    d. Owens Corning.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

I. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

J. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches.
2. Fabricate from the Following Materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Valley Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Drip Edges: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch.

D. Eave, Rake Flashing: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

F. Flashing Receivers: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inchesof corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws, but not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.

1.3 ALLOWANCES

A. Penetration firestopping Work is part of an allowance.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."
        3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hilti, Inc. ; CFS-DID. or a comparable product by one of the following:

a. 3M Fire Protection Products.
b. Specified Technologies, Inc.
c. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate

proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate inside of Storage Room at west and south walls.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing:

1. UL-Classified Systems: C-AJ-1149.
2. Rating: 1 hour.
3. Type of Fill Materials: As required to achieve rating.

C. Penetration Firestopping Systems for Nonmetallic Pipe, Conduit, or Tubing:

1. UL-Classified Systems: C-AJ-2631.
2. Rating: 1 hour.
3. Type of Fill Materials: As required to achieve rating.

D. Penetration Firestopping Systems for Miscellaneous Mechanical Penetrants:

1. UL-Classified Systems: W-J-7085.
2. Rating: 1 hour.
3. Type of Fill Materials: As required to achieve rating.

END OF SECTION 078413

SECTION 079200 – JOINT SEALANTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, and Division 1, General Requirements apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. The extent of caulking and sealants work shall be as herein specified and as indicated on the drawings including, but not necessarily limited to, the following:

- Exterior caulking between concrete/masonry and hollow metal work, louvers, control joints, and as shown.
- Interior caulking of joints between dissimilar materials.
- Interior caulking between masonry and metal work, and as shown.
- Interior caulking for corrective work, as directed.
- Exterior sealant between concrete construction and expansion joints above water.
- Exterior sealant between concrete construction and expansion joints below water.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

1. Section 032500 “Concrete Waterstops and Modular Pipe Seals” foe PVC, hydrophilic and modular pipe seals.
2. Section 033000 “Cast-in-Place Concrete for concrete substrates.
3. Section 042000 “Unit Masonry Assemblies” for concrete masonry substrates.
4. Section 044313 “Anchored Stone Masonry Veneer” for natural stone substrates.
5. Section 081113 “Steel Doors and frames” for steel substrates.
6. Section 131500 “Swimming Pools” for pool equipment and substrates.
7. Section 224300 “Plumbing Fixtures” for plumbing fixtures.

1.4 SUBMITTALS

A. For information only, submit two copies of manufacturer's specifications, recommendations and installation instructions for each type of sealant, caulking compound and associated miscellaneous materials required. Include manufacturer's published data that material is intended for the application required.

B. Submit samples of manufacturer's standard colors for Architect's selection for all sealants exposed to view.

1.5 WARRANTY

A. Provide the owner with two copies of the written warranty that all caulking and sealants, including materials and workmanship, throughout the building and swimming pools shall be watertight for a period of at least five years from date of the final acceptance of the facility.

B. The warranty shall cover removal and replacement of other work which has been superimposed on the caulking work, as required to repair or replace the caulking work, without cost to the Owner.

C. The warranty shall be signed by the Contractor and by the Installer.

1.6 QUALITY ASSURANCE

A. Provide only products of manufacturers with not less than five years of successful experience in supplying the principal materials for the required work.

B. Before purchase of sealants, investigate the compatibility with the joint surfaces, joint filler and other materials in the joint system. Provide only materials which are known to be fully compatible with the actual installation conditions as shown by manufacturers published data or certification.

C. Installer must be a firm with a minimum of five years successful experience in the application of the types of materials required and who employs only skilled tradesmen for the work.

PART 2 PRODUCTS

2.01 Materials:

A. Basis-of-Design Product: Subject to compliance with requirements, provide named or comparable product by one of the following:

1. Dow Corning Corporation
2. Pecora Corporation
3. Tremco Corporation
4. Sika Corporation, Construction Products Division

B. Interior: Elastomeric, single component, FS TT-S-00230C(2), Sikaflexia, by Sika Chemical Corp.: Tremco Manufacturing Company: Pecora: or approved equal.

C. Interior: Acrylic Latex, Pecora AC-20 or approved equal.

D. Interior: Non-staining, non-corrosive gun grade compound, oil based, FS-TT-C598b, Type 1, Pecora 200-R2, or approved equal.

E. In Swimming Pool (Below Water Line): Two -part polysulfide rubber sealant. Type II with 25% Extension, 25% compression. Sealant to meet Federal Specifications TT-S-00227E, Type II, Class B; ASTM C-920, and must meet or exceed the ASTM C-1247 for sealants exposed to continuous immersion in liquids. Product to be equivalent to that as manufactured by Pecora Corporation, Synthacalk GC-2+. Color to match, as closely as manufacturer's standard will allow, pool paint.

F. Exterior (Above Water): Two Part, self-leveling polyurethane traffic grade sealant. Sealant to meet Federal Specifications TT-S-00227E, Class A, Type I; SS-S-195B and SS-S-159B; ASTM D-1850 and ASTM C920-87, Class 25, Type M, Grade P, Use T. Product to be equivalent to "Urexpan NR-200" as manufactured by Pecora Corporation.

G. Joint filler: Expanded polyethylene rod stock; non-staining to sealant in accordance with ASTM D-925. Provide size and shape of rod which will compress min. 25% and control and joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion with joint compressed.

H. Joint cleaner: Provide the type of cleaning compound recommended by the sealant or caulking compound manufacturer for the joint surfaces to be cleaned.

I. Joint primer/sealer: Provide the type recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.

J. Back-up material in joint (subjected to foot traffic). Solid neoprene or butyl rubber (Shore A hardness of 70).

K. Bond breaker tape (polyethylene) shall be used in shallow joints.

PART 3 EXECUTION

3.1 INSPECTION

A. The Installer must examine the substrate and the conditions under which caulking work is to be performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PREPARATION

A. Clean the substrate of projections and substances detrimental to the work, comply with recommendations of the prime materials manufacturer.

B. Apply priming compound to all surfaces at joints to receive polysulfide sealant in accordance with manufacturer's directions. Mask surfaces where required and remove immediately after sealing is completed.

C. Inspect interior surfaces and remove loose or friable material. Wire brush concrete and corroded metals: remove dust and loose debris. Make trial adhesion test for painted surfaces and remove paint films having inadequate bond.

D. Etch concrete and masonry joint surfaces to remove excess alkalinity unless sealant manufacturer's printed instruction indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5 percent solution of muriatic acid; neutralize with diluted ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

E. Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

F. Prime interior masonry as recommended by the manufacturer of the sealant material. Rake out joints to depth not less than joint width.

G. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion) (in compliance with Paragraph 4.3.9 of FS TT-S-00337) has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

3.3 INSTALLATION

A. Do not proceed with installation of sealants under adverse weather conditions or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range so that sealant will not be subjected to excess elongation and bond stress at subsequent low temperatures. Coordinate time schedule with General Contractor to avoid delay of project.

B. Install sealants to depths as shown or, if not shown, as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.

1. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width but neither more than 1/2" deep nor less than 1/4" deep.
2. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75 percent of 125 percent of joint width.
3. Apply and handle sealant in accordance with the manufacturer's written instructions with a minimum exposure to air. Hold the caulking nozzle at 45

degree angle to joint and push sealant ahead of nozzle, forcing materials into the joint.

4. Tool joint 10 minutes after application to produce a concave surface and remove masking tape immediately. Do not use soap detergent or other lubricants that would discolor sealant.
5. Install polysulfide sealant in accordance with Thiokol Corp. Architectural Specification Guide.
6. Install bond breaker tape wherever required by manufacturer's recommendation to ensure that elastomeric sealants will perform properly.
7. Finished joint shall be smooth and wrinkle free, with concave surface.
8. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesion strength and surface durability.

3.4 CLEANING

A. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces or to migrate into the voids of adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces by either the primer/sealer or the sealant/caulking compound.

B. Remove excess compound and sealant promptly as the work progresses. Clean surrounding materials. Cut out defective joints, prime and reseal.

C. Clean surfaces of excess sealant in accordance with manufacturer's directions.

END OF SECTION 079200

SECTION 081113 - STEEL DOORS AND 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 SUMMARY

A. This Section includes the following:

1. Steel doors.
2. Steel door frames.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for installing anchors and grouting frames in masonry construction.
2. Division 8 Section "Door Hardware" for door hardware and weather stripping.
3. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details and finishes.
B. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Steel Doors and Frames:

a. Amweld Building Products, Inc.
b. Ceco Door Products; a United Dominion Company.
c. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.
B. Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 4 and Physical Performance Level A (Maximum Duty), Model 2 (Seamless).

2.4 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.093-inch- thick steel sheet, hot-dipped galvanized for:

1. Level 4 steel doors.

C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

D. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

A. General: Fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

B. Core Construction: One of the following manufacturer's standard core materials that produce a door complying with SDI standards:

1. Vertical steel stiffeners.

C. Clearances for Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

D. Single-Acting, Door-Edge Profile: Beveled edge

E. Double-Acting, Door-Edge Profile: Round vertical edges with 2-1/8-inch radius.

F. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

G. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

H. Exposed Fasteners (At existing openings only): Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

I. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier.

Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

I. Frame Construction: Fabricate frames to shape shown.

1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
2. Provide welded frames with temporary spreader bars.
3. Provide terminated stops at interior frames.

J. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

K. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.6 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

3.2 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawing 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 the following:

1. Wall access doors and frames.
2. Floor doors and frames.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
2. Division 4 Section "Unit Masonry Assemblies" for anchoring and grouting access door frames set in masonry construction.

1.3 SUBMITTALS

A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

C. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames of any one type, through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Access Doors:

a. Acudor Products, Inc.
b. Bar-Co, Inc. Div.; Alfab, Inc.
c. Cendrex, Inc.
d. Cesco Products.
e. Elmdor/Stoneman; Div. of Acorn Engineering Co.
f. Jensen Industries.
g. J. L. Industries, Inc.
h. Karp Associates, Inc.
i. Larsen's Manufacturing Company.
j. MIFAB Manufacturing, Inc.
k. Milcor Limited Partnership.
l. Nystrom Building Products Co.
m. Precision Plumbing Products, Inc.
n. Williams Bros. Corporation of America (The).

B. Manufacturer: Products that may be incorporated into the Work include, the following:

1. Floor Doors:

a. Bilco Company (The).
b. USF Fabrication Inc.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.

C. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), with Class C coating and phosphate treatment to prepare surface for painting; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M for uncoated base metal.

E. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316; with minimum sheet thickness indicated representing specified thickness according to ASTM A 480/A 480M.

G. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

H. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

I. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

2.3 PAINT

A. Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.4 ACCESS DOORS AND FRAMES

A. Flush, Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.

1. Locations: Masonry wall surfaces.
2. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch-wide, surface-mounted trim.
6. Hinges: Continuous piano hinge.
7. Automatic Closer: Spring type.
8. Latch and Lock: Self-latching bolt operated by key from exterior and with free-egress interior release.

2.5 FLOOR DOORS

A. Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle.

B. Furnish and install where indicated on plans vault access door Type J-AL H20, size width (36 inch) x length (36 inch) or JD 2AL, size width (48 inch) x length (48 inch). Length denotes hinge side. The vault access door shall be single leaf fir 36" doors and double leaf for 48" doors. The vault access door shall be pre-assembled from the manufacturer.

C. Performance characteristics:

1. Cover: Shall be reinforced to support AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span. Manufacturer to provide structural calculations stamped by a registered professional engineer upon request.
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire door, including all hardware components, shall be highly corrosion resistant and suitable for highly corrosive environments.

C. Cover: Shall be 1/4" (6.3 mm) aluminum diamond pattern.

D. Frame: Channel frame shall be 1/4" (6.3mm) extruded aluminum with bend down anchor tabs around the perimeter. A continuous EPDM gasket shall be mechanically attached to the aluminum frame to create a barrier around the entire perimeter of the cover and significantly reduce the amount of dirt and debris that may enter the channel frame.

E. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.

F. Drain Coupling: Provide a 1-1/2" (38mm) drain coupling located in the right front corner of the channel frame.

G. Lifting mechanisms: Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate.

H. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug. Provide Mcgard security plugs in lieu of panic hardware. Provide with City of Hartford pattern. Provide slam lock for operating door from interior.

I. Hardware:

1. Hinges: Heavy forged aluminum hinges, each having a minimum 1/4" (6.3 mm) diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame.
2. Cover shall be equipped with an hold open arm which automatically locks the cover in the open position.
3. Cover shall be fitted with the required number and size of compression spring operators. Springs shall have an electrocoated acrylic finish. Spring tubes shall be constructed of a reinforced nylon 6/6 based engineered composite material] .
4. A Type 316 stainless steel snap lock with fixed handle shall be mounted on the underside of the cover.
5. Hardware: Shall be anticorrosion throughout.

J. Finishes: Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

2.6 FABRICATION

A. General: Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. Provide mounting holes in frames to attach masonry anchors in masonry construction.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated (Mill) Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

2.9 METALLIC-COATED STEEL FINISHES

A. Galvanizing of Steel Shapes and Plates: Hot-dip galvanize items indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pretreating.

2.10 STEEL FINISHES

A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

2.11 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Polish: No. 4 finish.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames, and floor doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install floor doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.
B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 081113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Overhead Coiling Counter Doors, manually operated.

1.2 RELATED SECTIONS

A. Section 055000 - Metal Fabrications: Support framing and framed opening.

B. Section 087100 - Door Hardware: Product Requirements for cylinder core and keys.

1.3 REFERENCES

A. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.4 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Details of construction and fabrication.

4. Installation methods.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years of experience in the fabrication and installation of security closures.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Install in areas designated by Architect.

2. Do not proceed with remaining work until workmanship and installation is approved by Architect.

3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 COORDINATION

A. Coordinate Work with other operations and installation of adjacent finish materials to avoid damage to installed materials.

1.9 WARRANTY

A. Warranty: Manufacturer’s limited door warranty for 2 years for all parts and components.

B. Manufacturer’s 5 year limited warranty for PowderGuard Weathered Powder Coat Finish applied to complete door system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.

B. Substitutions: Subject to compliance with the specified product requirements, provide the specified product or a comparable product by another manufacturer, including, but not limited to the following:

1. Atlas Door; Div. of Clopay Building Products Company, Inc.
2. Raynor.
3. Wayne-Dalton Corp.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 OVERHEAD COILING STEEL DOORS

A. Galvanized Steel Doors: Overhead Door Corporation, 650 Series.

1. Wall Mounting Condition:

a. Face-of-wall mounting at doors

b. Jamb-mounted at window shutters.

2. Curtain: Interlocking slats, Type F-158 fabricated of 22 gauge galvanized steel. Endlocks attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.

3. Finish:

a. Slats and hood galvanized steel in accordance with ASTM A 653 with rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester (powder coated) top coat.

1) Powder coat: PowderGuard

(a) PowderGuard Weathered Finish: Industrial textured powder coat provides a thicker, more scratch resistant coat. Applied to entire door system including slats, guides, bottom bar and head plate.

b. Non-galvanized exposed ferrous surfaces for guides, bottom bar and head plates shall receive one coat of rust-inhibitive primer.

4. Bottom Bar:

    a. Steel tubular locking bottom bar with weatherstrip.

5. Guides: Extruded aluminum.

    a. Finish: PowderGuard Weathered finish with iron/black powder.

6. Brackets: Steel plate to support counterbalance, curtain and hood.

7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel.

8. Hood: Provided with intermediate support brackets as required and fabricated of galvanized primed steel.

    a. Provide hood without manufacturer's labels and advertising visible in finished application.

9. Operation:

    a. Manual push up.

10. Locking:

    a. Two point dead locks with mortise cylinder/s in the closed position. Coordinate cylinders with Section 087100 "Door Hardware".

    b. At Door Number 8, 22, 23 and 26 cylinder lock to be operable from inside.

    c. At Doors Number 10, 13A, 13B and 20 cylinder lock to be operable from the exterior.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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 in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

G. Install perimeter trim and closures.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION 083323

SECTION 085113 - ALUMINUM WINDOWS

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 Architectural Aluminum Windows including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of window units.

1. Types of aluminum windows include: Fixed Aluminum Windows.

2. Glazing includes: laminated glass

3. Window Film includes: Translucent and opaque films.

B. Related Sections:

1. Division 012100 "Alternates”

1.3 DEFINITIONS and STANDARDS

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

B. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed window system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

a. Basic Wind Speed (MPH): 95

B. Window Performance Requirements:

1. Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS)

a. Performance Class and Grade: F-HC40.

2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E283 at a minimum size of 72" x 72" (1829 x 1829). Air infiltration rate shall not exceed 0.30 cfm/ft^2 at a static air pressure differential of 6.24 psf (300 Pa).

3. Water Resistance: The test specimen shall be tested in accordance with ASTM E547 and ASTM E331 at a minimum size of 72" x 72" (1829 x 1829). There shall be no leakage as defined in the test method at a static air pressure differential of 10 psf (479 Pa).

4. Uniform Load Structural: A minimum static air pressure difference of 60 psf (2873 Pa) shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load.

5. Component Testing: Window components shall be tested in accordance with procedures described in AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

6. U-FactorTest: thermal testing per NFRC 102 at the prescribed 47” x 59" (1194 x 1499) test size glazed with 1” insulating glass made with 1/8” clear exterior glass lite, thermoplastic butyl spacer, krypton gas, and 1/8” glass with a soft coat low E coating on the #3 surface of the interior glass lite: Standardized Thermal Transmittance to be maximum 0.32 BTU/HR/SQ.FT/°F.

7. Forced Entry Resistance: All windows shall conform to ASTM F588, Grade 10.

8. Thermal Barrier Test: Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum windows and components required.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for type(s) of window(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.

1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 ALUMINUM WINDOWS

A. Basis-of-Design Product:

1. Traco

2. Series NX-380 (Thermally Broken) Fixed Window

3. 3-1/4" (83 mm) frame depth

4. F-HC40

B. Subject to compliance with requirements, provide a comparable product by the following:

1. EFCO Corporation

2. Kawneer North America, an Alcoa Company

C. Substitutions: Refer to Substitutions Section for procedures and submission requirements.

1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.

2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid window installation and construction delays.

3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.

4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for window system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum windows for a period of not less than ten (10) years. (Company Name)

5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.

6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 WINDOW MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070” (1.8 mm) wall thickness at any location for the main frame and sash members.

B. Thermal Barrier: The thermal barrier shall consist of integral structural thermal break made with glass-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.

C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

F. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer, ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than 3/16” and as needed to comply with requirements and that is compatible with window system specified.
3. Interlayer Color: Clear unless otherwise indicated.

B. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer’s standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type .062" (1.57 mm) glazing beads with an interior gasket in accordance with AAMA 702 or ASTM C864.

2.4 ACCESORIES

A. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

B. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

C. Sealants and joint fillers for joints at perimeter of window system as specified in Division 7 Section "Joint Sealants".

D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

E. Optional Exterior Panning and Interior Trims: Extruded aluminum, 6063-T6 alloy and temper, extruded to profiles and details indicated. Seal exterior joints with manufacturer's standard sealant to assure water-tight joints.

1. Exterior Panning and Trims: All panning profiles shall be a minimum thickness of 0.062” (1.57 mm) to match the profiles as shown the drawings. Any profile variations shall be submitted to the architect and/or owner for approval 10 days prior to bid date. All panning shall be factory fabricated for field assembly. All corner joinery shall be factory cut. Joinery at the sill shall be coped and butt-type construction. All preparations for assembly shall be completed by the window manufacturer. Upon assembly, panning frame joints shall be back-sealed to prevent moisture penetration.

2. Interior Trims: The interior face trim minimum wall thickness shall be 0.062” (1.57 mm). The face trim shall snap-fit onto concealed mounting clip. Exposed fasteners shall not be accepted. The mounting clip shall be extruded aluminum of 6063-T6 alloy and temper. The minimum wall thickness shall be 0.062” (1.57 mm). The trim clips shall be provided in 3” (76.2 mm) lengths and spaced a maximum of 18” (457.2 mm) center to center.

F. Coupling Mullions: Shall be extruded aluminum of 6063-T6 alloy and temper of profile and dimensions indicated on drawings. Mullions shall provide structural properties to resist wind pressure required by performance criteria and standards.

2.5 WINDOW FABRICATION

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fit joints; make joints flush, hairline and weatherproof.

3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.

5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

6. Provisions for field replacement of glazing.

7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Window Frame Joinery: Mitered and Mechanically clipped and/or staked. Factory sealed frame and corner joints.

C. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

D. Fabricate aluminum windows that are re-glazable without dismantling sash or framing.

E. Thermally Broken Construction: Thermal barriers shall be designed in accordance with AAMA TIR A8.

1. Thermal Barrier: The thermal barrier shall consist of integral structural thermal break made with glass-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.

2. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093” (2.4 mm) thick extruded aluminum. Miter or cope corners, and join with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.

G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match frame.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:

1. 70% PVDF, AAMA 2605, Fluoropolymer Coating (Color TO BE SELECTED BY Architect from manufacturer's full range of standard options).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install aluminum framed window system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum framed window system and components to drain condensation, water penetrating joints, and moisture migrating within system to the exterior.

E. Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing Standard shall be per AAMA 502 including reference to ASTM E783 for Air Infiltration Test and ASTM E1105 for Water Penetration Test.

a. Air Infiltration Test: Conduct test in accordance with ASTM E783 at a minimum uniform static test pressure of 1.57 psf (75 Pa) for CW or 6.24 psf (300 Pa) for AW. The maximum allowable rates of air leakage for field testing shall not exceed 1.5 times the project specifications.

b. Water Infiltration Test: Water penetration resistance tests shall be conducted in accordance with ASTM E1105 at a static test pressure equal to 2/3 the specified water test pressure.

2. Testing Extent: Architect shall select window units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present.

3. Test Reports: Shall be prepared according to AAMA 502.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

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. Mechanical door hardware for the following:

a. Swinging doors.
b. Exit gates in chain-link pool enclosure.

2. Cylinders for door hardware specified in other Sections.

B. Related Sections:

1. Section 081113 "Steel Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.
3. Section 323113 "Chain Link Fences and Gates" for access and egress gate hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
d. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
5) Fastenings and other pertinent information.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1 for door hardware on doors in an accessible route.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products, which comply with BHMA designations referenced.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed first below, or a comparable product by one of the another manufacturer, including, but not limited to those listed:

1. Ives; an Ingersoll Rand Brand
   a. Standard Hinge: Ives 5BB1HW, Heavy Weight Full Mortise Hinge (A5111-Stainles Steel)
   b. Swing-Clear Hinge: Ives 5BB1SCHW, 5 Knuckle, Ball Bearing, Swing Clear Heavy Weight Full Mortise Hinge (A8121-Steel, with Stainless Steel Finish US32D.
2. Baldwin Hardware Corporation
3. Hager Companies
4. Stanley Commercial Hardware, a Division of Stanley Security Solutions

B. Hinges: Antifriction-Bearing, Full-Mortise (Butt) Hinges: Heavy weight; BHMA Grade 1, with all bearings; button tips; non-removable pins.

2.3 MECHANICAL LEVER-LOCK SETS AND LATCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed first below, or a comparable product by one of the another manufacturer, including, but not limited to those listed:

1. Sargent Manufacturing Company– Assa Abloy: 9200 High Security Locksets
   a. Lever Locksets with Storeroom Function: 9200 Series – Function 35, with L-Lever and L-Rose.
   b. Lever Lockset with Privacy Function: 9200 Series – Function 66 with L-Levers and L-Roses.
   c. Deadbolts: 9200 Series Function 21 with 130 SKB Thumb Turn and #824 Anti-Vandal Trim – 04 Function with latch Protection.
2. Stanley Commercial Hardware, a Division of Stanley Security Solutions
3. Yale Commercial hardware.

B. Lock Throw: Comply with testing requirements for length of bolts as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1.25-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

E. Mortise Locks: BHMA A156.13; Security Grade 1; stamped steel case with stainless steel or brass parts; Series 1000.

F. Locks: BHMA A156.13; Grade 1; Series 1000.

2.4 SURFACE BOLTS

A. Surface Bolts: BHMA A156.16.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed first below, or a comparable product by one of the another manufacturer, including, but not limited to those listed:

1. Ives; an Ingersoll Rand Brand
   a. Surface Bolts: Provide Top and Bottom; SB360 Surface Bolt with 1 1/4:" throw.
2. Rockwood; Assa Abloy, Model 585
3. Hager Companies
4. Stanley Commercial Hardware, a Division of Stanley Security Solutions

2.5 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA Grade 1.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed first below, or a comparable product by one of the another manufacturer, including, but not limited to those listed:

1. Sargent; Assa Abloy
   a. Interior Applications: Sargent 8900 Series Mortise Lock Exit Device with Concealed Verical Rods. Exterior trim to be FLL Pull, 04 Function.
   b. At Chain Link Exit Gates: Detex, Model ECL-230X-W (Weatherized deadbolt) Exist Control Hardware, with 100 decibel battery alarm. Coordinate latch mechanism with gate manufacturer.
2. Stanley Commercial Hardware, a Division of Stanley Security Solutions
3. Yale Commercial Hardware

2.6 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Compatible with Owner's Master Keying System..

B. High-Security Lock Cylinders: BHMA A156.30; Grade 1; Type M, mechanical; permanent cores that are removable; face finished to match lockset.

C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Master Key System: Change keys and a master key operate cylinders.
2. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
3. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
4. Existing System:

    a. Master key or grand master key locks to Owner's existing system.

5. Keyed Alike: Key all cylinders to same change key.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

    a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

    a. Cylinder Change Keys: Three.
    b. Master Keys: Five.
    c. Grand Master Keys: Five.
    d. Great-Grand Master Keys: Five.

2.8 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.9 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.

B. Astragals: BHMA A156.22.

2.11 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed first below, or a comparable product by one of the another manufacturer, including, but not limited to those listed:

1. Sargent; Assa Abloy: Sargent 1431 Series Aluminum Closer for 45-minute UL Listed opening.
2. DORMA Door Controls, Inc. Member of the DORMA Group
3. LCN Closer, an Ingersoll-Rand Company
4. Norton Door Controls, a Division of Yale Security, Inc.

2.12 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed first below, or a comparable product by one of the another manufacturer, including, but not limited to those listed:

1. Ives; an Ingersoll Rand Brand
   a. Floor Stop without Hold-Open: Ives FS 438 Dome Stop. Brass with US26D finish.
   b. Floor Stop with Hold-Open: Ives FF446, Floor Stop with Manual Hold-Open. Brass with US26D finish.
2. Baldwin Hardware Corporation
3. Hager Companies
4. Stanley Commercial Hardware, a Division of Stanley Security Solutions

2.13 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Hager Companies
2. Pemko Manufacturing Co.
3. Zero International, Inc.

2.14 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of stainless steel base metal unless otherwise indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2.16 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner may engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Prior to start-up for the 2015 swim season, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE:

A. Provide weatherstrip at all exterior doors.

B. Hardware groups are noted on door schedule on drawings.

Group 1:
Doors 1

- (3 pair) Swing-Clear Hinges
- (2) Panic Rail Exit Devices with concealed bolts.
- (2) Exterior Trim, Pull with Deadbolt
- (1) Door Coordinator
- (1) Astragal
- (2) Floor Stops with hold-open eye and hook

Group 2:
Doors 2 and 3

- (3 pair) Hinges
- (1)Deadbolt with key operation outside and thumb latch inside.
- (1) Rosette with Pull
- (1) Set Surface Bolts

Group 3:
Doors 4, 7, 11, 16 and 17

- (3) Hinges
- Floor Stop
- Lever Lockset, Function: Privacy

Group 4:
Doors 8, 10, 13A, 13B, 20, 22, 23 and 28

- Provide cylinder lockset. Refer to Section 083323 “Overhead Coiling Doors” for additional information. At Door #8 cylinder is operable from the interior. At all other doors cylinder is operable from the exterior.

Group 5:
Doors 9, 12, 14, 18, 21, 24 and 25

- (3) Hinges
- (1)Deadbolt with key operation outside and thumb latch inside.
- (1) Rosette with Pull
- Floor Stop

Group 6:
Doors 5, 6 and 19

- (3) Hinges
- (1)Deadbolt with key operation outside and thumb latch inside.
- (1) Rosette with Pull

Group 7:
Door 15 and 26

- (3 pair) Swing-Clear Hinges
- (2)Deadbolt with key operation outside and thumb latch inside.
- (2) Rosette with Pull
- (1) Door coordinator
- (1) Astragal
- (2) Floor Stops with hold open eye and hook.

Group 8: (45 Minute Rated Door Hardware)
Door 27

- (3) Hinges
- (1) Lever Lockset: Storeroom Function
- (1) Closer
- (1) Floor Stop

END OF SECTION 087100

SECTION 089000 - LOUVERS AND VENTS

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 the following:

1. Fixed, extruded-aluminum louvers.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide louvers 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.

B. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

1. For installed louvers and vents indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of metal finish required.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel, unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings recommended by manufacturer.

1. Exposed Mullions: Where required, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

F. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louvers

1. Basis-of-Design Product: Airolite, Extruded Aluminum Drainable Louver, Model K609HP, or a comparable product including, but not limited to one of the following:

    a. Ruskin Company, Tomkins, PLC
    b. Construction Specialties, Inc.

2. Louver Depth: 4 inches
3. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch for blades and 0.080 inch for frames.
5. Mullion Type: Exposed.
6. Performance Requirements:

    a. Free Area: Not less than 8.5 sq. ft. for 48-inch- wide by 48-inch- high louver.
    b. Point of Beginning Water Penetration: Not less than 768 fpm .

7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver and at all existing louvers scheduled to remain.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. For existing louvers, provide reinforced, extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached. Mill finish, at existing louvers.
3. Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic-Coating Finish: AA-C12C42R1x (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 coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
   a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

SECTION 099100 - PAINTING

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 surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish. Do not paint ductwork. Do not paint stainless steel or hot-dipped galvanized hangers and supports.
2. Painting of ferrous metals within the following spaces is specified in Section 099600 “High-Performance Coatings”.

a. Maintenance Building (all interior surfaces and materials)
b. Swimming Pools
c. Basketball Court Markings

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Toilet enclosures.
b. Finished Pool Equipment.
c. Finished mechanical and electrical equipment.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.

b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.

3. Finished metal surfaces include the following:

a. Anodized or Mill Finished aluminum.
b. Stainless steel.
c. Copper and copper alloys.
d. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
2. Division 7 Section “Crystalline Waterproofing” or finishing of Surge Tank and Backwash Holding Tank.
2. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
3. Division 9 Section "High-Performance Coatings" for industrial paints and maintenance and for special coatings, including swimming pool paint, concrete sealers and epoxy paint for ferrous metals in corrosive atmospheres.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Initial Selection: For each type of finish-coat material indicated.

1. After color selection, Architect will furnish color chips for surfaces to be coated.

C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit Two Samples on the following substrates for Architect's review of color and texture only:

a. Concrete Unit Masonry: 4-by-8-inch Samples of masonry, with mortar joint in the center, for each finish and color.
c. Painted Wood: 8-inch- square Samples for each color and material on hardboard.
e. Ferrous Metal: 4-inch square Samples of flat metal and 6-inch- long Samples of solid metal for each color and finish.

D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Benjamin Moore & Co. (Benjamin Moore).
2. ICI Dulux Paint Centers (ICI Dulux Paints).
3. PPG Industries, Inc. (Pittsburgh Paints).
4. Sherwin-Williams Co. (Sherwin-Williams).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.

1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils.
2. Benjamin Moore; Moore's IMC Latex Block Filler No. M88: Applied at a dry film thickness of not less than 8.1 mils, for gloss finishes.
3. ICI Dulux Paints; Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler: Applied at a dry film thickness of not less than 7.0 to 14.5 mils.
4. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils.
5. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.4 EXTERIOR PRIMERS

A. Exterior Wood Primer for Acrylic Enamels: Factory-formulated alkyd or latex wood primer for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Exterior Primer No. 176: Applied at a dry film thickness of not less than 1.8 mils.
2. ICI Dulux Paints; 2000-1200 Dulux Professional Exterior 100 Percent Acrylic Latex Primer: Applied at a dry film thickness of not less than 1.6 mils.
3. Pittsburgh Paints; 6-609 SpeedHide Exterior House & Trim Wood Primer 100 Percent Acrylic Latex: Applied at a dry film thickness of not less than 1.6 mils.
4. Sherwin-Williams; A-100 Exterior Latex Wood Primer B42W41: Applied at a dry film thickness of not less than 1.4 mils.

B. Exterior Ferrous-Metal Primer: Refer to Division 9 Section “High Performance Coatings” .

C. Exterior Galvanized Metal Primer: Refer to Division 9 Section “High Performance Coatings”.

2.5 INTERIOR PRIMERS

A. Interior Wood Primer for Acrylic-Enamel and Semigloss Alkyd-Enamel Finishes: Factory-formulated alkyd- or acrylic-latex-based interior wood primer.

1. Benjamin Moore; Moorcraft Super Spec Alkyd Enamel Underbody and Primer Sealer No. 245: Applied at a dry film thickness of not less than 1.5 mils.
2. ICI Dulux Paints; 3210-1200 Ultra-Hide Aquacrylic GRIPPER Stain Killer Primer Sealer: Applied at a dry film thickness of not less than 1.8 mils.
3. Pittsburgh Paints; 6-855 SpeedHide Latex Enamel Undercoater: Applied at a dry film thickness of not less than 1.0 mil.
4. Sherwin-Williams; PrepRite Wall and Wood Primer B49W200 Series: Applied at a dry film thickness of not less than 1.6 mils.
5. Sherwin-Williams; PrepRite Classic Interior Primer B28W101 Series: Applied at a dry film thickness of not less than 1.6 mils, under semigloss acrylic enamel finishes.

B. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer. At Pool Filter Rooms, Pump Pits and areas subject to chloramines atmosphere, refer to 09960 “High Performance Coatings”.

1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film
2. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils.
3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 1.5 mils.
4. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils.

C. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. ICI Dulux Paints; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
4. Sherwin-Williams; primer not required over this substrate.
5. Sherwin-Williams; Galvite HS B50WZ30: Applied at a dry film thickness of not less than 3.0 mils, under alkyd finishes.

2.6 EXTERIOR FINISH COATS

A. Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Low Lustre Latex House Paint No. 185: Applied at a dry film thickness of not less than 1.0 mil .
2. ICI Dulux Paints; 2402-XXXX Dulux Professional Exterior 100 Percent Acrylic Satin Finish: Applied at a dry film thickness of not less than 1.4 mils.
3. Pittsburgh Paints; 6-2000 Series SpeedHide Exterior House & Trim Satin--Acrylic Latex: Applied at a dry film thickness of not less than 1.0 mil.
4. Pittsburgh Paints; 90-400 Series Pitt-Tech One Pack High Performance Waterborne Satin DTM Industrial Enamels: Applied at a dry film thickness of not less than 3.0 mils over zinc coated metal.
5. Sherwin-Williams; A-100 Exterior Latex Satin House & Trim Paint A82 Series: Applied at a dry film thickness of not less than 1.5 mils.

B. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.
1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils.
2. ICI Dulux Paints; 2406-XXXX Dulux Professional Exterior 100 Percent Acrylic Semi-Gloss Finish: Applied at a dry film thickness of not less than 1.3 mils.
3. Pittsburgh Paints; 6-900 Series SpeedHide Exterior House & Trim Semi-Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils.
4. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils.

2.7 INTERIOR FINISH COATS

A. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils.
2. ICI Dulux Paints; 1402-XXXX Dulux Professional Acrylic Eggshell Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.4 mils.
3. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils.
4. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series: Applied at a dry film thickness of not less than 1.6 mils.

B. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils.
2. ICI Dulux Paints; 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.5 mils.

3. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil.
4. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series: Applied at a dry film thickness of not less than 1.3 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete unit masonr to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to

remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
c. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
d. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Paint mechanical and electrical and pool piping that is exposed in equipment rooms and occupied spaces.

F. Mechanical and Pool Equipment items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Ductwork exposed throughout the buildings.
6. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
7. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
8. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items, if not pre-finished or stainless steel, to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Testing agency will perform appropriate tests for characteristics deemed salient by the Owner.
3. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

A. Concrete at Pools: Do not paint. Refer to 099600 “High Performance Coatings” for epoxy paint.

B. Smooth Wood, Transparent Finish: Provide the following finish systems over smooth wood siding, plywood siding panels and other smooth wood:

1. Low-Luster Acrylic Finish: Two finish coats over a primer.

a. Primer: Alkyd, Sanding Sealer, Clear.
b. Finish Coats: Stain, Exterior, Water Based, Solid Hide.

C. Wood Trim, Transparent Finish: Provide the following finish systems over exterior wood trim:
1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Alkyd, Sanding Sealer, Clear.
b. Finish Coats: Stain, Exterior, Water Based, Solid Hide.

3.8 INTERIOR PAINT SCHEDULE

A. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.

a. Block Filler: Concrete unit masonry block filler.
b. Finish Coats: Interior semigloss acrylic enamel.

B. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a wood undercoater.

a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
b. Finish Coats: Interior semigloss acrylic enamel.

C. MDO Paneling: Provide the following paint finish systems over new interior wood surfaces:

1. Two coats, clear satin Polyurethane.

D. Ferrous Metal (Other than those in spaces specified in 1.2 above): Provide the following finish systems over ferrous metal:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior ferrous-metal primer.
b. Finish Coats: Interior semigloss acrylic enamel.

E. Zinc-Coated Metal (Other than those in chloramines atmosphere) : Provide the following finish systems over interior zinc-coated metal surfaces:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.

a. Primer: Interior zinc-coated metal primer.
b. Finish Coats: Interior semigloss acrylic enamel.

F. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:

1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.

a. Finish Coats: Interior flat latex-emulsion size.

END OF SECTION 099100

SECTION 099600 - HIGH-PERFORMANCE COATINGS

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 surface preparation and field application of high-performance coating systems to items and surfaces scheduled. These coatings shall be used within the following spaces and for the following applications:

   a. Maintenance Building (all interior surfaces)
   b. Swimming Pools
   c. Graffiti Management for masonry

B. Related Sections include the following:

   1. Division 5 Sections "Metal Fabrications" and “Pipe Hangers and Supports for Swimming Pool Piping” for factory finished and hot-dipped galvanized ferrous metal.
   2. Division 7 Section “Crystalline Waterproofing” for waterproofing at surge tank and backwash holding tank.
   3. Division 9 Section "Painting" for general painting.
   4. Division 32 Section “Recreational Court Surfacing” for basketball court surfacing.

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this Section.

B. Gloss ranges used in this Section include the following:

   1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
   2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

C. Environments: The following terms are used in Part 2 of this Section to distinguish between different corrosive exposures:

   1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.
   2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development,

and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.
4. “Chloramine Atmosphere” are spaces where chlorine and/or chlorine vapors arepresent. These areas include Filter Plants, pump pits, surge tanks, filter out-buildings, etc.

1.4 SUBMITTALS

A. Product Data: For each coating system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.

B. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1. After color selection, Architect will furnish color chips for surfaces to be coated.

D. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped Samples defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. List of material and application for each coat of each sample. Label each sample for location and application.
3. Submit samples on the following substrates for Architect's review of color and texture:

    a. Concrete: Sealer, provide two 4-inch- square samples for each color and finish.
    b. Concrete Pool provide 8-inch square sample.
    b. Ferrous and Nonferrous Metal: Provide two 4-inch- square samples of flat metal and two 8-inch- long samples of solid metal for each color and finish.

E. 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.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:

1. Name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.7 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F .

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product for High Perormance Coatings: Subject to compliance with requirements, provide the products of Tnemec Company, Inc., or a comparable product by one of the following:

1. Carboline Company (Carboline).
2. DuPont Company, High Performance Coatings (DuPont).
3. ICI Dulux Paints; Devoe Coatings (ICI).
4. Moore: Benjamin Moore & Co. (Moore).
5. Pittsburgh Paint; PPG Industries, Inc. (PPG).
6. Sherwin Williams; Industrial and Marine Coatings (S-W).
7. Insl-X, Superior Coating Systems (Insl-x)

B. Basis-of-Design Product for Grafitti Management Coatings: Subject to compliance with requirements, provide the products of Diedrich, Inc., or a comparable product by one of the following:

1. Carboline Company (Carboline).
2. SIKA.

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

2.3 COLORS

A. Colors: As selected by Architect from manufacturer's full range.

2.4 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Concrete Swimming Pool Floor and Walls: Provide the following finish systems over concrete surfaces:

a. Epoxy: Two finish coats.

1. Primer: Tnemec Series 66 High Build Epoxoline
2. Finish Coat: Tnemec Series 66 High Build Epoxoline

B. Ferrous Metal: Provide the following finish systems over exterior ferrous-metal surfaces:

1. Moderate Environment (Semigloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.

1) Carboline: 893 2-Component Cross-Linked Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Devran 224HS High Build Epoxy.
4) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
5) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.
6) S-W: Recoatable Epoxy Primer B67 Series/B67V5.
7) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 8.0 mils.

1) Carboline: 890 2-Component Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.
3) S-W: Heavy Duty Epoxy B67W300 Series.
4) Tnemec: Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.

c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils.

1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
2) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
3) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.

d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils.

1) Carboline: Carboline 133 HB Aliphatic Polyurethane.
2) DuPont: Imron 326 (13P) Semi-Gloss Polyurethane Enamel.
3) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
4) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.

5) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
6) S-W: Corothane II Satin B65W400 Series.
7) Tnemec: Series 75 Endura-Shield.

C. Nonferrous Metal: Provide the following finish systems over exterior nonferrous-metal surfaces:

1. Moderate Environment (Semigloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.

1) Carboline: Rustbond Penetrating Sealer SG.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Devran 4170 Corrosion Resistant Epoxy Primer.
4) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
5) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.
6) S-W: DTM Wash Primer B71Y1.
7) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.0 mils.

1) Carboline: 890 2-Component Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.
3) Tnemec: Intermediate coat not required.

c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils.

1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
2) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
3) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
4) S-W: Corothane II Satin B65W200 Series.
5) Tnemec: Intermediate coat not required.

d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils.
1) Carboline: 133 HB Aliphatic Polyurethane.
2) DuPont: Imron 326 (13P) Semi-Gloss Polyurethane Enamel.
3) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
4) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
5) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
6) S-W: Corothane II Satin B65W200 Series.
7) Tnemec: Series 75 Endura-Shield.

2.5 INTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Ferrous Metal: Provide the following finish systems over interior ferrous-metal surfaces:

1. Severe Environment; Chloramine Atmosphere (Semigloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.

1) Carboline: 888 2-Component Polyamide Epoxy at 2.0 to 4 mils (0.051 to 0.102 mm).
2) DuPont: 25P High Solids Epoxy Mastic at 4.0-mil (0.102-mm) dry film thickness.
3) ICI: Devran 224HS High Build Epoxy at 4.0-mil (0.102-mm) dry film thickness.
4) International: Intergard 251 Thin Film Polyamide Epoxy Rust Inhibitive Primer at 2.0-mil (0.051-mm) dry film thickness.
5) Moore: M33/M34 Polyamide Epoxy Metal Primer at 2.0-mil (0.051-mm) dry film thickness.
6) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating at 6.0-mil (0.152-mm) dry film thickness.
7) R-O: 9500 System High Build Polyamide Epoxy at 5.0- to 8.0-mil (0.127- to 0.203-mm) dry film thickness.
8) S-W: Recoatable Epoxy Primer B67 Series/B67V5 at 4.0- to 6.0-mil (0.102- to 0.152-mm) dry film thickness.
9) Tnemec: 27 F. C. Typoxy Polyamide Epoxy.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 4.0 mils (0.051 to 0.102 mm).

1) Carboline: 888 2-Component Polyamide Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Devran 224HS High Build Epoxy.
4) International: Intergard 345 DTM Semi-Gloss Epoxy.
5) Moore: M36/M38 Polyamide Epoxy Semi-Gloss Coating.
6) PPG: 97-1XXX Series Aquapon High Build Semi-Gloss Polyamide Epoxy Coating.
7) R-O: Intermediate coat not required.
8) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
9) Tnemec: Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.

c. Topcoat: Semigloss epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils (0.051 to 0.127 mm).

1) Carboline: 888 2-Component Polyamide Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.

3) ICI: Devran 224HS High Build Epoxy.
4) International: Intergard 345 DTM Semi-Gloss Epoxy.
5) Moore: M36/M38 Polyamide Epoxy Semi-Gloss Coating.
6) PPG: 97-1XXX Series Aquapon High Build Semi-Gloss Polyamide Epoxy Coating.
7) R-O: 9500 System High Build Polyamide Epoxy at 5.0- to 8.0-mil (0.127- to 0.203-mm) dry film thickness.
8) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
9) Tnemec: Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.

B. Nonferrous Metal: Provide the following finish systems over interior nonferrous-metal surfaces:

1. Severe Environment; Chloramine Atmosphere (Semigloss Finish): One finish coat over an intermediate coat and a primer.

a. Primer: Acrylic or epoxy primer, as recommended by manufacturer for this substrate, applied at spreading rate recommended by manufacturer.

1) Carboline: 888 2-Component Polyamide Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Devran 4170 Corrosion Resistant Epoxy Primer.
4) International: Intergard 251 Thin Film Polyamide Epoxy Rust Inhibitive Primer.
5) PPG: 97-14XX Series Pitt-Guard DTR Epoxy.
6) R-O: 9500 System High Build Polyamide Epoxy at 5.0- to 8.0-mil (0.127- to 0.203-mm) dry film thickness.
7) S-W: DTM Wash Primer B71Y1.
8) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils (0.051 to 0.127 mm).

1) Carboline: 888 2-Component Polyamide Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.
3) ICI: Devran 224HS High Build Epoxy.
4) International: Intergard 345 DTM Semi-Gloss Epoxy.
5) PPG: 97-1XXX Series Aquapon High Build Semi-Gloss Polyamide Epoxy Coating.
6) R-O: Intermediate coat not required.
7) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
8) Tnemec: Intermediate coat not required.

c. Topcoat: Semigloss epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils (0.051 to 0.127 mm), unless otherwise indicated.

1) Carboline: 888 2-Component Polyamide Epoxy.
2) DuPont: 25P High Solids Epoxy Mastic.

3) ICI: Devran 224HS High Build Epoxy.
4) International: Intergard 345 DTM Semi-Gloss Epoxy.
5) PPG: 97-1XXX Series Aquapon High Build Semi-Gloss Polyamide Epoxy Coating.
6) R-O: 9500 System High Build Polyamide Epoxy at 5.0- to 8.0-mil (0.127- to 0.203-mm) dry film thickness.
7) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
8) Tnemec: Series 66 Hi-Build Epoxoline.

C. Concrete Masonry Units: Refer to Division 9 Section “Painting”

D. Wood: Refer to Division 9 Sections “Painting”

2.6 ANTI-GRAFITTI COATING SYSTEMS

A. Natural Stone and Pre-cast Stone: Provide the following finish systems over interior ferrous-metal surfaces:

1. On all natural stone and cast-stone copings, headers and shapes:

a. Diedrich Technologies, Inc.; 333 Omegaseal Water Repellent & Grafitti Management System.

PART 3 - EXECUTION

3.1 EXAMINATION

A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.

1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:

a. Confirmation of primer's suitability for expected service conditions.
b. Confirmation of primer's ability to be top coated with materials specified.

2. Notify Architect about anticipated problems before using the coatings specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
    a. Use abrasive blast-cleaning methods as recommended by coating manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
3. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
    a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10/NACE No. 2.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
4. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
    a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

    a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
    b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required is the same regardless of application method.

    a. Omit primer on metal surfaces that have been shop primed and touchup painted.
    b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
    c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
    d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.

2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.

   a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
   b. Brush out and work brush coats into surfaces in an even film.
   c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.

   a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
   b. Apply each coat to provide the equivalent hiding of brush-applied coats.
   c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.

D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.

1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

F. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:

1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:

    a. Quantitative materials analysis.
    b. Absorption.
    c. Accelerated weathering.
    d. Accelerated yellowness.
    e. Color retention.
    f. Alkali and mildew resistance.
    g. Abrasion resistance.
    h. Apparent reflectivity.
    i. Washability.
    j. Dry opacity.
    k. Recoating.
    l. Skinning.

3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

3.5 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 099600

SECTION 101400 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General Conditions and Division 1 General Requirements shall apply to the work specified in this section.

B. Extent of the work under this section is shown on the key plan located at the end of this section.

1.2 DESCRIPTION OF WORK

A. Form of signs shall include the following:

1. Room Identification Signs
2. Panel Signs

1.3 QUALITY ASSURANCE

A. For each sign form and graphic image process indicated, furnish products of a single manufacturer.

1.4 SUBMITTALS

A. Submit shop drawings for fabrication and erection of specialty signs. Include plans, elevations, and large scale details of sign wording and lettering layout. Show anchorage and accessory items. Furnish location template drawings for items supported by or anchored to permanent construction.

B. Submit manufacturer's technical data and installation instructions for each type of sign required.

C. Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics. Submit full size sample units if requested by the Architect. Acceptable units may be used as part of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, manufacturer's offering products which may be incorporated in the work include, but are not limited to the following:

- ASI Sign Systems, Inc.
- Andco Industries Corp.
- Best Manufacturing

B. For purposes of establishing a referenced standard of quality, products of ASI Sign Systems are specified.

2.2 TYPE, CONSTRUCTION AND ACCESSORIES

A. Provide cast (not extruded or continuous cast) methacrylate plastic sheet, in sizes and thickness' indicated; with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176 degrees F (80 deg. C) and of the following type:

1. Opaque sheet: Provide colored opaque acrylic sheet in colors and finishes indicated, or if not indicated, as selected by the Architect from manufacturer's standard range of colors.

B. Fasteners shall be concealed type, fabricated from metals that are non-corrosive to either the sign material or the mounting surface.

C. Use non-ferrous metal or hot-dipped galvanized anchors and inserts for all installations for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

D. All signs to be "Weatherproof".

E. Room Identification Signs shall be equivalent to ASI Sign Systems, "ASI EmBoss"

F. Panel Signs shall be equivalent to ASI Sign Systems, "ASI SPG".

2.3 FABRICATION

A. Fabricate Panel signs to comply with the requirements indicated for materials, thickness', finishes, colors, designs, shapes, sizes and details of construction. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16" measured diagonally.

B. Fabricate unframed panel signs with edges mechanically and smoothly finished to conform with following requirements:

- Edge Condition:	Square cut
- Corner Condition:	Provide corners rounded to 1/4" R
- Symbol and Copy	Die Cut

C. Permanently laminate face panels to backing sheets of material and thickness' indicated using the manufacturer's standard process, unless otherwise indicated.

D. All panel signs to be minimum .3125 (5/16") thick consisting of .0625" (1/16") clear matte acrylic laminated to .25" (1/4") acrylic.

E. Sizes of signs shall be as follows:

1)	Room Identification	7 5/8" x 7 5/8" (8 3/4” x 8 3/4” for signs with pictograms)
2)	Directional Signs	7 5/8" x 7 5/8"
3)	Special Signs	As required, actual size shall be determined during shop drawing review to be appropriately sized for locations

F. Provide sign copy to comply with the requirements indicated for sizes, styles, spacing, content, positions, materials, finishes and colors of letters, numbers, symbols and other graphic devices.

1) Letters shall be Helvetica, 72 pt, upper and lower case standard for Room Identification signs and Helvetica, 120 pt., upper and lower case for directional signs.

2) Normal letter spacing and line spacing shall be standard. Tight letter spacing shall be used initially when sign size is insufficient for copy. If sign size is still insufficient then copy shall be reduced to one point size at a time until copy fits as specified above.

3) Primary message shall be positioned on signs on a two line grid layout. All signs shall use a left/centered message copy layout.

G. For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

H. All signs (except special signs) shall have Raised and Braille Characters and Pictograms. Raised characters shall be raised 1/32", upper-case, sans serif or simple serif type. The letter height shall be between 5/8" and 2" as specified above. Grade 2 Braille shall be accompanied by the equivalent verbal description placed directly below the pictogram.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate sign units and accessories where shown or scheduled or as directed by Architect in the field, using mounting methods of type described and/or required and in compliance with the manufacturer's instructions, and suitable for the intended substrate unless otherwise indicated.

B. Install sign units level, plumb and at the height indicated or directed by Architect, with the sign surfaces free from distortion or other defects in appearance.

C. The typical mounting height shall be 60 inches from the finished floor or deck to the center of the sign.

D. Attach signs to wall, equipment or posts with appropriate liquid silicone adhesive, or hanging method recommended by the sign manufacturer.

1. At chain-link fence installations, provide blank panel backing to create a sandwich panel either side of chain-link fabric. Provide tamper-proof hardware to install sandwich.

3.2 CLEANING AND PROTECTION

A. At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

SIGNAGE SCHEDULES BEGIN ON THE NEXT PAGE.

3.03 SCHEDULE

SIGN TYPE	QUANTITY	MESSAGE
A	2	Phone for Emergency Use In Lifeguard Office"
B	3	"Police, Fire, Ambulance DIAL 911" sign to be graphic symbol (VERIFY '911' or "9-911)
C	2	"Men's Locker Room" with symbol for accessibility and gender
D	2	"Women's Locker Room" with symbol for accessibility and gender
E	4+ 4 Blank Panel	"Emergency Exit Only-Alarm Will Sound"
F	1	"Lifeguard Office"
G	2	"First Aid", with Red Cross (prov. one with directional arrow)
H	5	"Staff Only – Danger"
I	3	"Storage – Staff Only"
J	1	"Concessions – Staff Only"
K	1	"Park Maintenance – Staff Only"
L	4	"Unisex Toilet Room" – with symbols for accessibility and genders
M	2+ 1 Blank Panel	Pool Rules – Sign Message 1 (see message on following pages)
N	2 + 1 Blank Panel	Pool Rules – Sign Message 2 (see message on following pages)
O	2 + 1 Blank Panel	State and City Pool Rules, Sign Message 3 (see message on following pages)
P	2	"These doors need to be closed and locked when facility is not open to the public & staffed and unlocked at all times when the facility is open and staffed. (approximate sign size 12" x 16")

A.04 SPECIAL SIGN MESSAGES – PANEL SIGNS

A. ***Sign Type M*****, Sign Message 1: (Approximate Panel Size is 36" Wide x 48" High)**

LAP SWIMMING

PLEASE FOLLOW THESE GUIDELINES FOR A SAFE ENJOYABLE LAP SWIM:

1. Swim counter-clockwise, keep to the right side of the lane.
2. Always Allow for More Than Two People in the Lane.
3. Swim in a Lane That Fits Your Speed.
4. Leave Room at End Walls for Turns.
5. Pass in the Middle of the Lane.
6. Please Keep to the Right and Yield to the Swimmer Passing You.
7. Take Notice of the Other Swimmers' in your Lane.
8. Pool Staff Have Authority to Move Swimmers to Other Lanes, and to Enforce all Rules.

WATERSLIDE RULES

1. Swimmers only. Non-swimmers and beginners may not use the waterslide.
2. Only one rider at a time. Wait until the landing area is clear before entering the slide.
3. Slide feet first only.
4. No running, standing, kneeling, rotating, tumbling or stopping in the flume.
5. Leave the pool promptly after entering.
6. Follow the instrcutions of the Attendant, Staff and Lifeguards.

B. ***Sign Type N*****, Sign Message 2: (Approximate Panel Size is 36" Wide x 48" High)**

CLIMBING WALL RULES

1. Swimmers only. Non-swimmers and beginners may not use the climbing wall.
2. Climbers must be able to swim 25-yards and tread water for 30 seconds.
3. Climbers must read, understand and obey all posted rules, instructions and warnings.
4. Only one climber is allowed on the climbing wall at a time.
5. Only feet-first entries are allowed when entering the water. NO EXCEPTIONS!
6. Climbers who intentionally violate the NO DIVING rule WILL BE BANNED from using the climbing wall.
7. When entering the water, knees should be bent and arms extended for safety through increased deceleration.
8. Climber must immediately exit the drop zone when done with the climb. Exit the water at a ladder on either side of the climbing wall, or move to another area of the pool.
9. Use climbing wall only when lifeguard is on duty and approves such use.
10. Climber must obey all instructions given by the lifeguard.
11. Climb must begin from the water.
12. Diving may result in bodily injury or death.
13. Report any damage to equipment to the supervisor or lifeguard.

Diving Board Use

1. Board Users Must Be Able to Swim Unassisted to Nearest Ladder.
2. One Person on Board at a Time.
3. Jump or Dive Straight Out From End of Board.
4. One Bounce Only, Walking Approaches Only.
5. Exit Area By Swimming to the Nearest Ladder.
6. Area Under Board Must be Clear Before Next Diver Proceeds.
7. Foot Contact Only With Board (no gymnastics or sit-down dives).
8. On Head-First Entries, Diver's Hands Must Break Water First (no sailor or watermelon dives).

C. *Sign Type O*, Sign Message 3 (Approximate Panel Sign Size is 36" Wide x 48" High):

STATE POOL REGULATIONS

1. NO DIVING IS PERMITTED OFF THE DECK INTO SHALLOW AREAS OF THE POOL.
2. All Persons Shall Bathe With Warm Water and Soap Before Entering the Pool
3. Any Persons Known Or Suspected of Having a Communicable Disease Shall Not Use The Pool.
4. Spitting or Blowing the Nose in the Pool is Prohibited.
5. Running, Boisterous or Rough Play is Prohibited.

SWIMMING POOL RULES

1. Swimming is allowed only when the facility is open and Lifeguards are on Duty.
2. Appropriate proof of residency is required for admittance to faciltiy.
3. Non-residentss must be accompanied by a resident to use the facility.
4. Proper swim attire (bathing suit) is required in the water. Tight fitting rubber pants must be worn by infants. No disposable diapers.
5. Any persons known or suspected of having a communicable disease shall not use the pool.
6. All persons shall bathe with warm water and soap before entering the pool.
7. Running, boisterous, or rough play (except supervised water sports) is prohibited.
8. Spitting or blowing the nose in the pool is prohibited.
9. Talking with lifeguards on duty is prohibited.
10. Smoking and chewing gum are prohibited. Food and drinks are permitted in designated areas only, except plastic water bottles are allowed on pool deck.
12. Swim aids, face masks, pails, toys, etc. are prohibited in the water.
13. Keep off the lane lines and buoys.
14. No loitering in the Bathhouse.
15. Not responsible for valuables lost or stolen.
16. Nearest First Aid Station is located in the Lifeguard/First Aid Room .

The above rules serve as a guideline and are not to be taken as a complete set of rules for all situations. Violation of pool rules may mean suspension and/or loss of privileges at City Recreation Facilities.

END OF SECTION 101400

SECTION 102113 - TOILET PARTITIONS and SOLID PLASTIC CASEWORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, and Division 1, General Requirements apply to the work specified in this Section.

1.02 DESCRIPTION OF WORK

A. The extent of the partition work is as shown on the drawings and specified herein including, but not necessarily limited to, the following:

- Toilet Compartments
- Countertops and Shelves
- Associated Hardware and Fittings
- Benches

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

10800 Toilet Accessories

1.04 SUBMITTALS

A. As applicable, shop drawing submission shall: include published manufacturer technical data; indicate materials and components, including composition, sizes, thickness', schedule of quantities and locations, layout, finishes and color; indicate assembly and installation details, including clearances, opening sizes, supports, fasteners, anchors, reinforcing, inserts, connections to the work of the other trades and hardware coordination.

B. Color samples: Manufacturer standard, marbleized and specialty color ranges. Architect may select from any available color.

1.05 QUALITY ASSURANCE

A. Except as otherwise specified herein, or specifically approved in accordance with applicable section of General Conditions, all items under this Section shall be the product of a single manufacturer.

B. Take field measurements prior to fabrication, to ensure best fit and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approved manufacturers, subject to compliance with these specifications, include, but are not limited to the following:

1.	Bobrick Washroom Accessories	1080/1180 Duraline
2.	Columbia Partitions, Inc.	"Poly-Pro"
3.	Knickerbocker Partition Corp.	"New Plastique"
4.	Scranton Products, Santana	"Poly-Mar H.D."

2.02 TYPE, CONSTRUCTION AND ACCESSORIES

A. Solid Plastic Partitions: Provide floor-supported and over head braces, consisting of panels and fabricated with extra smooth finish. Edges of all components, including pilasters shall be ground smooth. In-swing doors shall be 24" wide and out-swing and handicapped accessible shall be 34".

1. Heat-Sink Strip: Manufacturer's standard, continuous, clear-anodized extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.

B. Hardware and fittings:

1. Brackets for attachment of panels and pilasters to walls and panels to pilasters (except as specified herein below) shall be Zamac, stainless steel. Brackets at exposed end partitions shall be continuous ‘C’ channel.

2. Attachment of panels to the edges of pilasters when installed in line shall be continuous steel channel of same materials and finish as pilaster.

3. Floor anchorages of pilasters shall be concealed by 3" stainless steel plinths.

4. Doors shall be equipped with inset-type hinges with opposing nylon cams with stainless steel pintels in self-lubricating bearings which shall set to hold all in-swinging doors in partially open position when not latched. Out-swinging doors shall have cams set to hold doors closed when at rest.

5. Doors shall have Zamac latches with emergency access feature; a matching cast combination strike and keeper with live rubber bumper; and chrome plated coat hook with rubber tip.

6. Manufacturer shall supply all necessary hardware, stiffeners and braces as required for a rigid system, as well as rigidity within each panel.

C. All compartments shall be cut and reinforced, as required, to receive accessories provide under other sections.

D. Dressing compartments constructed same as toilet compartments with curtain track and hooks in overhead rail. Refer to Division 10 “Toilet Room Accessories” for curtain.

E. Benches shall be solid plastic benches, width x length indicated. At benches against vertical surfaces, provide ½” space bench and wall or other vertical surface, unless otherwise detailed. Benches to be supported on manufacturer’s standard factory finished aluminum pedestals, anchored firmly to floor and to bench with tamper resistant hardware.

F. Countertops and Shelves shall be solid plastic in sizes and configurations as shown. Provide necessary brackets manufactured from the same materials.

PART 3 EXECUTION

3.01 INSTALLATION

A Installation shall be performed by mechanics familiar with, and skilled in, the application of the items specified, under the supervision of an authorized manufacturer representative, resulting in workmanship in compliance with the best industry practice.

B Erect all work rigid, straight, plumb and level. Secure partitions to walls with two stirrups through bolted to partition and bolted to walls with two bolts. Use expansion bolts and shields in masonry. Use toggle bolts at stud walls. Keep wall ends of partitions free of walls approximately 3/4".

C Anchor pilasters to floor with galvanized bolts in expansion shields. Anchors shall be accessible for leveling and tightening and shall be concealed by pilaster plinth.

D. All evidence of drilling, cutting and fitting of wall and floor finish shall be concealed in finish work. Clearance of vertical edge of doors shall be uniform from top to bottom and shall not exceed 1/4". Carefully adjust hardware and leave in perfect working order. Finished surfaces shall be cleaned and left free from imperfections.

END OF SECTION 102113

SECTION 102116 - PLASTIC SHOWER AND DRESSING COMPARTMENTS

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. Solid-plastic compartments.
2. Shower receptors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments to the overhead structural system.
2. Section 102113 “Toilet Partitions and Solid Plastic Casework
3. Section 102800 "Toilet and Bath Accessories" for grab bars, folding benches, and similar accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For shower and dressing compartments.

1. Include plans, elevations, sections, and attachment details.
2. Show locations of cutouts for compartment-mounted accessories.
3. Show locations of centerlines of drains.
4. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of compartment material indicated.

1. Include Samples of hardware and accessories for material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for compartments, prepared on 6-inch-square Samples of same thickness and material indicated for the Work.

2. Each type of hardware and accessory.
3. Curtain Fabric: 12-inch-square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of shower and dressing compartment.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower and dressing compartments to include in maintenance manuals.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of fixtures, drains, walls, columns, ceilings, and other construction contiguous with shower and dressing compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Class C
2. Flame-Spread Index: 76 - 200.
3. Smoke-Developed Index: 0 - 450.

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for shower and dressing compartments designated as accessible.

2.2 SOLID-PLASTIC COMPARTMENTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products; or a comparable product by one of the following:

1. Columbia Lockers; Partition Systems International of South Carolina.
2. Global Partitions; ASI Group.
3. Knickerbocker Partition Corporation.
4. Marlite.

B. Configuration: Shower and dressing compartments, as indicated on Drawings.

C. Enclosure Style: Overhead braced.

D. Panel and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.

1. Heat-Sink Strip: Manufacturer's standard, continuous, clear-anodized extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
2. Color and Pattern: One color and pattern in each room; as selected by Architect from manufacturer's full range, matching toilet compartments specified in Section 102113.19 "Plastic Toilet Compartments".

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; solid plastic or stainless steel.

1. Plastic Color and Pattern: Match pilaster .

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; clear-anodized extruded aluminum.
2. Stirrup Type: Ear or U-brackets; clear-anodized aluminum.
3. Dressing-Compartment Brackets: Match toilet-compartment brackets specified in Section 102113.19 "Plastic Toilet Compartments."

2.3 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221.

C. Brass Castings: ASTM B 584.

D. Brass Extrusions: ASTM B 455.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

F. Stainless-Steel Castings: ASTM A 743/A 743M.

2.4 ACCESSORIES

A. Overhead Bracing: Manufacturer's standard, continuous, extruded-aluminum headrail or cap with antigrip profile; in manufacturer's standard finish.

B. Headrail with Hooks: Manufacturer's standard, continuous, extruded-aluminum headrail or cap with curtain hooks running in concealed track; with antigrip profile; in manufacturer's standard finish.

C. Curtain: Flame-resistant, polyester-reinforced vinyl fabric that is stain resistant, self-sanitizing, antistatic, antimicrobial, and launderable to a temperature of not less than 90 deg F.

1. Flame Resistance: Passes NFPA 701 tests when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
2. Labeling: Identify fabrics with appropriate markings of applicable testing and inspecting agency.
3. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.
4. Width: Minimum 12 inches wider than opening.
5. Length: Where curtain extends to a floor surface, size so that bottom hem clears finished floor by not more than 1 inch and not less than 1/2 inch above floor surface.
6. Color and Pattern: As selected by Architect from manufacturer's full range.

D. Seats: Manufacturer's standard, wall-mounted benches.

1. Material: Molded plastic.
2. Operation: Fixed. For folding bench, refer to Section 102800 “Toilet and Bath Accessories”.
3. Finish: Match enclosure panels.

E. Anchorages and Fasteners: Manufacturer's standard, exposed fasteners of stainless steel, chrome-plated steel, or solid brass, finished to match the items they are securing; with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. Use countersunk, flush-type bolt heads or otherwise make fasteners inconspicuous if exposed on opposite side of panel from hardware or accessory item. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.5 FABRICATION

A. Overhead-Braced Compartments: Manufacturer's standard, corrosion-resistant supports, leveling method, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling method.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install compartments rigid, straight, level, and plumb. Secure compartments in position with manufacturer's recommended anchoring devices.

1. Clearances for Dressing Compartments: Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls.

2. Full-Height (Continuous) Brackets for Dressing Compartments: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Compartments: Secure pilasters to floor, and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous headrail to each pilaster with no fewer than two fasteners.

C. Curtains: Install curtains to specified length, and verify that they hang vertically without stress points or diagonal folds.

3.2 ADJUSTING

A. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.

B. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation.

END OF SECTION 102116

SECTION 102800 - TOILET AND BATH ACCESSORIES

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 the following:

1. Toilet and bath accessories.

B. Related Sections include the following:

1. Section 102113 “Toilet Partitions abd Solid Plastic Casework” for compartments and screens.
2. Section 102116 “Plastic Shower and Dressing Room Compartments” for curtain rods, hooks and curtains.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Samples: For each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

E. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule on the drawings.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Accessories shall be by Bobrick Washroom Equipment, Inc. except as otherwise noted in accessory schedule.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

C. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. Schedule is on the drawings.

END OF SECTION 102800

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

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. This Section includes the following:

1. Portable fire extinguishers.

2. Mounting brackets for fire extinguishers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

1. Fire Extinguishers: Include rating and classification.

B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

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 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209.
2. Extruded Shapes: ASTM B 221.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

2.3 PORTABLE FIRE EXTINGUISHERS

A. Available Manufacturers:

1. JL Industries, Inc.
2. Kidde Fyrnetics.
3. Larsen's Manufacturing Company.

B. General: Provide fire extinguishers of type, size, and capacity for each mounting bracket indicated.

1. Valves: Nickel-plated polished brass body.
2. Handles and Levers: Stainless steel.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

C. Regular Dry-Chemical Type: UL-rated 6 lb. nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

2.4 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

1. Color: Black.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

C. Identification: Apply decals at locations indicated.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 104400

SECTION 116823 - EXTERIOR COURT ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section “Summary”, Paragraph 1.1A, entitled “Related Documents.”

1.2 SUMMARY

A. Section includes exterior athletic equipment as follows:

1. Basketball court equipment.

B. Related Requirements:

1. Section 033000 “Cast in Place concrete” for footings and foundations.
2. Section 321823.43 “Recreational Court Surfacing” for court surfacing and striping.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of equipment.

1. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For basketball equipment and finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of basketball equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures.
    b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion unless indicated otherwise.
    a. Basketball Precast Concrete Pole – two years against failure in workmanship and materials.
    b. Backboards – Structural components – two years against defects in material and workmanship.
    c. Basketball Rims – one year against defects in workmanship and material.

PART 2 - PRODUCTS

2.1 BASKETBALL EQUIPMENT

A. Pole: Basis of Design Standard: Model TF7175 precast concrete as manufactured by Wausaumade, Wausau, WI 800 388-8728 www.wausaumade.com or Approved Equal.

1. Dimensions: 104” x 30” x 145”

2. Hardware:
    a. (2) 5/8” lifting inserts
    b. (2) 5/8” Brace Inserts
    c. (4) 3/8” mounting inserts
3. Anchoring:
    a. (4) 1” Dia. X 14” Anchor bolts – extend 7” above footing. Anchoring required by installer. Bolts must be installed in footing prior to delivery.

4. Finish: Premium Acid Wash Stain color S23 Gray
5. Anti-Graffiti Coating: Perma Clean non-sacrificial coating to be applied by manufacturer.
6. Provide pole with backboard and rim. Coordinate mounting requirements for backboard and goal with pole manufacturer.

B. Backboard: Basis of Design Standard – Model TF7182 as manufactured by Bison Inc. for Wausaumade, Wausau, WI 800 388-8728 www.wausaumade.com or Approved Equal.

1. Rectangular Steel Backboard
2. 72 inch wide x 42" high
3. Durable white powder coated finish
4. Goal mounting pattern to match precast concrete pole.
5. Brace arms

C. Rim: Basis of Design Standard – Model TF7178 Double-Rim Flex Goal as manufactured by Bison Inc. for Wausaumade, Wausau, WI 800 388-8728 www.wausaumade.com or Approved Equal.
1. 5/8" Steel Ring
2. 15 degree of deflection, auto return
3. No-fail netlock system
4. Include mounting hardware and nylon net
5. Color: Orange

2.2 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch-maximum-size aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading required for basketball equipment and surfacing is completed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install basketball court equipment in accordance with manufacturer written instructions and shop drawings.

3.3 PROTECTION/CLEAN UP

A. Protect all items until acceptance of the project. Replace or refinish the surfaces if damaged prior to acceptance.

B. Clean up all debris from installation procedures.

END OF SECTION 116823

SECTION 116833 - ATHLETIC FIELD EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

A. Section includes athletic field equipment as follows:
   1. Baseball field equipment.
   2. Baseball field backstop and fence surround.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated Design Submittal: For structural performance of chain-link fence backstop and frameworks, including analysis data signed and sealed by the qualified professional engineer, licensed to practice in the State of Connecticut, responsible for their preparation.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For athletic field equipment and finishes to include in maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of playfield equipment that fail in materials or workmanship within specified warranty period.

   1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion unless indicated otherwise.
   a. Baseball Bases – 12 months
   b. Baseball Pitcher's Rubber – 12 months
   c. Baseball Homeplate – 12 months
   d. Team Benches – 3 years
   e. Baseball Backstop – See Section 323113 "Chain Link Fence and Gates"

PART 2 - PRODUCTS

2.1 BASEBALL FIELD EQUIPMENT

A. Bases: Basis of Design Standard: Breakaway Style Base Set Model BB-700 as manufactured by Jaypro Sports LLC, 976 Hartford Turnpike, Waterford, Ct (800) 243-0533, www.jaypro.com or Approved Equal.
   1. Fully compliant with little league rules.
   2. Quick release base
   3. Official size 15" x 15" x 3"
   4. Set includes:
      a. Three base covers
      b. Three rubber base plates
      c. Three 1 ½" anchors

B. Pitching Rubber: Basis of Design Standard: Professional Pitching Rubber Model PR-618 as manufactured by Jaypro Sports LLC, 976 Hartford Turnpike, Waterford, Ct (800) 243-0533, www.jaypro.com or Approved Equal.
   1. High-durability molded rubber exterior
   2. PVC tube interior
   3. 6" x 18" – Little League size

C. Homeplate: Basis of Design Standard: Major League Home Plate Model HP-200 as manufactured by Jaypro Sports LLC, 976 Hartford Turnpike, Waterford, Ct (800) 243-0533, www.jaypro.com or Approved Equal.
   1. High Durability molded rubber construction
   2. Stanchion mounted steel plate
   3. Plate with 1 ½" Anchor

D. Team Bench: Basis of Design Standard: 21' Portable Players Bench w/Shelf Model PBS-10 as manufactured by Jaypro Sports LLC, 976 Hartford Turnpike, Waterford, Ct (800) 243-0533, www.jaypro.com or Approved Equal.
   1. Provide mounting hardware to secure bench for level surface mounting.

2.2 BASEBALL FIELD BACKSTOP AND FENCE SURROUND

A. Delegated Design: For structural performance of chain-link fence backstop and frameworks.

B. Chain Link Fence: as per Section 323113 Chain Link Fences and Gates

C. Fence fabric mesh size to be 1-inch x 1-inch to prevent climbing.

D. Backstop height and width as detailed on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor soccer goals securely, positioned at locations indicated.

1. Install baseball bases, pitching rubber and home plate per manufacturer’s written recommended instructions unless instructed to turn over to Owner with installation instructions at time of substantial completion.

2. Install baseball backstop per manufacturer’s written recommended instructions.

END OF SECTION 116833

SECTION 129300 - SITE FURNISHINGS

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. Seating.
2. Bicycle racks.
3. Trash receptacles.
4. Drinking Fountains
5. Timber Guiderail – Base bid and Alternate No. 8.

B. Related Requirements:
1. Section 012300 “Alternates” for alternate bid items.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.
3. Section 321313 “Concrete Paving” for concrete walks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.5 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. Bench Replacement Planks: No fewer than three full-size units for each size indicated.
2. Trash Receptacle Inner Containers: one full-size units for each size indicated, but no fewer than one unit.
3. Anchors: six of each type indicated.

1.6 WARRANTY

A. Special Warranty: Hot Dipped Galvanzer's warranty for coatings that fail in materials or workmanship within specified warranty period.
1. Failures include:
   a. Hot dipped galvanizing process with 10% or more visible rust
   b. Finish failing to meet the performance specifications referenced in Article 2.7 STEEL AND IRON FINISHES below.
2. Warranty Period:
   a. Galvanizing Process: Twenty years.
   b. Finish: Five years.

B. Benches: Products will be free from defects in material and/or workmanship for a period of three years from the date of substantial completion.

C. Trash Receptacle: Products will be free from defects in material and/or workmanship for a period of three years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 SEATING

A. Basis of Design Standard: Neocombo backless bench as manufactured by Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, MI (800) 521-2546 www.landscapeforms.com

B. Frame: Cast aluminum.

C. Seat (no back):

1. Material:
   a. Cast Supports – made of A514 or 535 aluminum.
   b. Seat: Made of 6005A-T5 or 6105-T5 extruded aluminum.

c. Boards: slotted back side to provide a track for the stainless steel threaded mounting plates. Board thickness is 1-3/16" and ends are capped with profile shaped aluminum plate.

2. Seat Height: As indicated.
3. Seat Surface Shape: Contoured or dished.
4. Overall Width: 59 inches.
5. Overall Depth: As indicated.
6. Arms: None.
7. Mounting: Surface mounted with type 304 stainless steel anchor tabs installed.
8. Anchor bolts: Contractor to provide Stainless steel anchor bolts not provided by the manufacturer.

D. Aluminum Finish:
1. Cast aluminum supports - clear anodized.
2. Extruded aluminum boards – etched and clear anodized.

2.2 BICYCLE RACKS

A. Bicycle Rack Construction:

1. Frame: Steel.

a. Pipe OD: Not less than indicated on Drawings.

2. Style: Double-side parking.

a. Overall Height: As indicated.
b. Overall Width: As indicated.
c. Overall Depth: As indicated.
d. Capacity: Designed to accommodate no fewer than two bicycles.

3. Security: Designed to lock wheel and frame.
4. Installation Method: Surface flange anchored at finished grade to substrate indicated.

B. Steel Finish: hot dipped galvanizing, priming and architectural finish.

1. Color: Custom color as selected by Architect from manufacturer's full range.

C. Fasteners: Stainless Steel anchor bolts

2.3 Hot-Dip Galvanizing for bicycle racks:

1. Hot-dip galvanize exterior steel bicycle racks, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized bike racks.
3. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

4. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

C. For galvanized bicycle racks, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean bicycle racks of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Exterior bicycle racks: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of bicycle racks unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Primer coat shall be factory-applied prime coat. Apply primer within 12 hours after galvanizing and within 3 hours of surface preparation in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.

G. Architectural Finish: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Architect from manufacturer's full range.

H. Performance Criteria: Coatings must meet or exceed the criteria for the following categories as stipulated by the coatings manufacturer:
1. Primer:
   a. Abrasion Resistance – Method: ASTM D 4060 (CS17 Wheel, 1,000 grams load). 1 kg load Result: 200 mg loss.
   b. Adhesion – Method: ASTM D 4541 Result: 1050 psi
   c. Corrosion Weathering - Method: ASTM D 5894, 13 cycles, 4368 hours Result: Rating 10 per ASTM D 714 for blistering; Rating: 7 per ASTM D 610 for rusting
   d. Direct Impact Resistance- Method: ASTM D 2794 Result: 160 in. lbs.
   e. Flexibility – Method: ASTM D 3363 Result: 3B

f. Moisture Condensation Resistance – method: ASTM D 4585, 100 degrees F, 2000 hours Result: Passes, no cracking or delamination
g. Dry Heat Resistance- Method: ASTM D 2485 Result: 250 degrees F

2. Topcoat:
   a. Abrasion Resistance – Method: ASTM D 4060 CS17 Wheel, 1,000 cycles grams 1 kg load Result: 87.1 mg loss.
   b. Adhesion – Method: ASTM D 4541 Result: 1050 psi
   c. Direct Impact Resistance- Method: ASTM D 2794 Result: >28 in. lbs.
   d. Indirect Impact resistance – method: ASTM D 2794 Result: 12-14 in. lbs.
   e. Dry Heat Resistance – Method: ASTM D 2485 Result: 200 degrees F
   f. Salt Fog Resistance – Method: ASTM B 117 9000 hours Result: Rating 10 per ASTM D 714 for blistering
   g. Flexibility – Method: ASTM D 522, 180 degree bend, 1/8" mandrel Result: Passes
   h. Pencil Hardness – Method: ASTM D 3363 Result: 2H
   i. Moisture Condensation Resistance – method: ASTM D 4585, 100 degrees F, 1000 hours Result: No blistering or delamination
   j. Xenon Arc Test – ASTM D 4798 Result: Pass 300 hours
3. Clear Coat:
   a. Abrasion Resistance – Method: ASTM D 4060 CS17 Wheel, 1,000 cycles grams 1 kg load Result: 55 mg loss.
   b. Adhesion – Method: ASTM D 4541 Result: 1250 psi
   c. Direct Impact Resistance- Method: ASTM D 2794 Result: 120 in. lbs.
   d. Dry Heat Resistance – Method: ASTM D 2485 Result: 200 degrees F
   e. Salt Fog Resistance – Method: ASTM B 117 3000 hours Result: Passes no blistering or cracking
   f. Flexibility – Method: ASTM D 522, 180 degree bend, 1/8" mandrel Result: Passes
   g. Pencil Hardness – Method: ASTM D 3363 Result: HB
   h. Graffiti Resistance- Graffiti materials applied: epoxy ester spray, acrylic spray, alkyd spray, ballpoint pen ink, crayon, lipstick Result: All materials were removed easily and completely with either xylene or MEK

I. Quality Assurance for Hot-Dip Galvanizing and Factory-Applied Metal Coatings:

1. Galvanizing shall be performed by a company with a minimum of ten years experience in the successful application of hot-dip galvanizing utilizing the dry kettle process.
2. Factory-applied metal coatings shall be performed in a facility acceptable to the coating manufacturer.
3. Submit two 3 inch by 6 inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.
4. Engage the services of a galvanizer who has demonstrated a minimum of ten years experience in the successful performance of the processes outlined in this specification. The Architect has the right to inspect the facility where the work is to be done and who will apply the galvanizing and coatings approve or reject the galvanizer/galvanizing facility.
5. Handle and install materials with factory-applied coatings as recommended by galvanizer and coating manufacturer to prevent damage to coatings prior to and after installation.

6. Touch-up factory-applied metal coatings as recommended by galvanizer and coating manufacturer.
7. Certificate of compliance that the galvanizer has certified weighers on premises with a certification from the local municipality, and a certified scale or municipal scale has been utilized by the galvanizer.
8. Fabricator shall provide a notarized statement from the galvanizer, along with a description of the material processed, indicating that all work has been done in conformance with this specification prior to receiving payment.
9. Certificate of Compliance for Shop Drawing Review by Galvanizer: Submit galvanizer's certification that shop drawings for metal fabrications to receive metal coatings have been reviewed and that fabrications are acceptable to galvanizer for proper application of galvanizing and metal coatings. All drawings should be stamped by the galvanizer to indicate approval of design for galvanizing.
10. Substitutions or APPROVED EQUALS are defined as meeting the, aesthetic, durability and all other performance criteria as detailed in this specification. Substitution and/or APPROVED EQUALS requests shall be accompanied by proof that the substitution or APPROVED EQUAL meets or exceeds the aesthetic, durability and all other performance requirements of the specified. Approvals of the substitution and/or APPROVED EQUALS shall be the right of the Owner, Owner's Representative, the Architect or the Engineer. Coatings or processes not matching or exceeding the approved specified process including aesthetic, durability and all other performance criteria shall be removed and replaced at the expense of the contractor and all subcontractors that were involved with the supply of, and the application of the non conforming product. Intentional misrepresentation of processes is fraud.
11. Galvanizer/coater shall supply a certificate of compliance that all coatings have been performed in accordance with QP-3 standards and procedures.

2.4 TRASH RECEPTACLES

A. Basis of Design Standard: Petoskey Litter Receptacle as manufactured by Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, MI (800) 521-2546 www.landscapeforms.com

B. Steel Facing Surrounds: 11 gauge perforated steel.

C. Top Lid: Hinged lid

D. Liner: Custom 30 gallon polyethylene.

E. Receptacle Height: 42".

F. Overall Width: 20.5" dia.

G. Steel Finish: powder coated.

1. Color: As selected by Architect from manufacturer's full range.

H. Mounting: surface mount. Contractor to provide stainless steel anchor bolts.

2.5 DRINKING FOUNTAIN

A. Products: Subject to compliance with requirements, provide the following:
   1. Handicap Accessible (High-Low) Drinking Fountain Model 440SM as manufactured by Most Dependable Fountains, Inc., 5705 Commander Dr., Arlington, TN 38002-0587 (800) 552-6331.
      a. Access door with vandal resistant stainless steel screws.
      b. Recessed hose bib w/lockable door.
      c. Surface Mount Carrier.
      d. Valve box.
      e. Color: to be selected by the architect from the full range of manufacturer's colors.

2.6 TIMBER GUIDERAIL – BASE BID AND ALTERNATE NO. 8

A. Timbers:
   1. Rough sawn, No. 2 or better Southern Yellow Pine timbers.
   2. AWPA Standard U1, with .40 lbs., p.c.f. retention of waterborne ACQ-D preservative.
   3. Kiln dried or air dried before and after treatment or 25% maximum moisture content.

B. Hardware:
   1. Galvanized carriage bolts and nuts.
      a. Bolt – 3/4-inch x 12-inch x 10
      b. Nut – 3/4-inch x 10

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION 129300

SECTION 129350 – SHADE STRUCTURES

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. Shade Structures (Refer to Unit Prices)

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete footings.
2. Section 129300 “Site Furnishings” for site benches, trash receptacles, bike racks and drinking fountains.
3. Section 312500 "Structure Excavation Backfill" for excavation and backfill for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.5 WARRANTY:

A. Shade Structures: Warrants that the equipment will conform in kind and quality to the specifications listed in the Order Acknowledgment and will be free of defects in workmanship or materials.

1. Limited 20 Year Warranty on all upright posts and support structure frames against failure due to rust-through corrosion. This warranty excludes any cosmetic issues.

2. Limited 10 Year Warranty on all CoolNet™ fabrics and GORE™ TENARA™ stitching thread against degradation, cracking or material breakdown resulting from ultra-violet exposure, mold, or mildew, as well as on Turn-N-Slide™ fastening device and cables. This warranty excludes failure of fabric or threads due to chemical erosion.

3. Limited 1 Year Warranty for structural failure of moving parts, powder-coat finish, or any other product or part not covered by one of the above warranties.

PART 2 - PRODUCTS

2.1 Shade Structure

A. Products: Subject to compliance with requirements, provide the following :

1. Type 'A': Provide "Shade Walk" by Shade Systems, Inc., or a comparable product of another manufacturer.

2. Type 'B': Provide "Shade Kite" by Shade Systems, Inc., or a comparable product of another manufacturer.

B. Frame: All tubing used shall be cold-formed and milled per ASTM A-135 and ASTM A-500. Material testing is in accordance with ASTM E-8. Minimum yield is 40,000 psi with a minimum tensile strength of 45,000 psi on all posts. All tubing shall be pre-cut to appropriate lengths, and where applicable all outside surfaces shall be galvanized, with an interior corrosion-resistant zinc-rich coating. Where required, support pipes shall be schedule 40 hot-dip galvanized or powder-coated black steel. All fastening hardware shall be stainless steel.

C. All powder-coated parts are to be completely cleaned and a hot zinc phosphate pretreatment with non-chromic sealer is applied. Powder-coating is then electrostatically applied and oven-cured at 375 to 425 degrees Fahrenheit. Polyester powders shall meet or exceed ASTM standards for Adhesion, Hardness, Impact, Flexibility, Overbake Resistance, and Salt Spray Resistance. Colors shall be selected by the Architect from the manufacturer's full range of options

D. Structural frames are designed to employ CoolNet™ polyethylene shade fabric. Fabric is attached to frame using a vinyl covered minimum 1/4" diameter galvanized and clear vinyl coated cable. Cable fasteners are zinc-plated copper for maximum corrosion resistance.

E. Structures are engineered to meet or exceed the requirements of International Building Code (IBC), and the following *standard* specifications:

Wind Speed (Frame only):	150 m.p.h.
Wind Speed (Frame w/canopy):	95 m.p.h.

F. SHADE FABRIC: Knitted of monofilament and tape construction high density polyethylene with Ultra Violet (U.V.) stabilizers and flame retardant. UV-Block Factor varies by standard color offered from 91% to 99%.

Nominal Thickness:	0.057 inches
Fabric Mass:	Min. 337 g/m^2
Light Fastness:	7-8 (Blue Wool Scale)
Weather Fastness:	4-5 (Grey Scale Test)
Tear Resistance:	Warp 210N
	Weft 276N
Breaking Force:	Warp 786N
	Weft 1544N
Bursting Pressure:	Mean 3125kPa
Bursting Force:	Mean 1775N

1. All hems and seams are double row lock stitched using exterior grade UV-stabilized polyethylene GORE™ TENARA™ sewing thread (GORE and TENARA are trademarks of W. L. Gore & Associates).

G. FLAMMABILITY: Shade Fabric to be treated with fire retardants, and passes the requirements established under the NFPA 701 Test Method 2 test standards for flammability, including the accelerated water leaching protocol. Written evidence of compliance with this standard, including the accelerated water leaching protocol, must be furnished with bid proposal

F. Assembly hardware: stainless steel, as supplied by manufacturer.

2.2 MATERIALS

A. Hardware: Stainless steel; commercial quality.

2.3 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.4 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

C. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

END OF SECTION 129300

SECTION 131000 - SWIMMING POOLS, GENERAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division-1 Specifications sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The intent of this section is to describe and specify a complete swimming pool system including coordination of structure, recirculation system and piping, filtration and chemical treatment systems, deck equipment, spray features and equipment and safety and maintenance equipment. The Contractor shall bring to the attention of the Architect prior to the submission of the bid, any inconsistency or deficiency in specified materials or equipment which might prove detrimental to the overall operation of the system; and the Contractor shall include in his/her bid all items of equipment and materials, etc., required for proper system operation according to codes and best established practices, whether drawn and/or specified, or not.

B. Immediately after signing of contract, a meeting will be held with the contractor, pool foreman, pool equipment manufacturers, owner, and Architect to review all aspects of pool and systems in detail. All components and equipment will be reviewed at that time prior to shop drawing submission. Any changes, conflicts, etc. will be discussed and resolved. All warranties will be given to the Architect at that time for review and acceptance.

C. The Contractor shall be responsible for providing, installing, and final sizing of all piping and pumps, valves, etc., for the pools and for providing any additional items or larger sizes than that specified which may be required for proper operation of the pool system.

D. The pool shell shall be the configuration shown on the drawings. The Contractor shall be responsible for constructing the pool shell completely as intended by these Contract Documents, and as required to achieve the configuration intended. The Contractor shall be responsible for the coordination of work specified in other Divisions of the specifications with work specified in Division 13.

E. Design Standards: All appropriate pool layout, dimensions, materials, etc. shall meet U.S. Swim requirements, and state and local health department requirements. The Contractor must verify and perform all regulatory requirements.

F. Codes: It shall be the responsibility of the Contractor to ensure that the work and materials furnished under this contract shall be in conformance with the code requirements of the State of Connecticut Health Department, City of New Britain, National Sanitation Foundation and the Virginia Graham Baker Act, as well as all applicable state and local building codes.

G. Permits and Fees: The Contractor shall provide all construction drawings, engineering reports, tests, and other data required to obtain permits from all appropriate governing agencies, including federal, state and local governments. The Contractor shall obtain all necessary

inspections and shall pay all permit and application fees relating to the swimming pool and related work.

1.3 QUALITY ASSURANCE

A. The methods, materials and equipment herein specified are intended to be the basis for receiving bids. Unless noted as "No Substitutions", substitutions will be considered in accordance with the provisions stated in these specifications.

B. Substitution of Equipment: Due to standardization of equipment across the City of New Britain, certain swimming pool equipment Manufacturer(s) is/are named to match other equipment at other pools in the City. As such, where "No Substitutions" is noted, the named manufacturer and model number shall be provided.

C. Where particular brand names are specified, but not noted as "No Substitutions", they are intended as a standard of quality and performance. Proposals based on the use of alternate equipment or equal substitutions must be submitted to the Owner and Architect 10 days prior to bid opening. The burden of proof of conformance of substitutions shall rest with the Contractor. The Architect/Owner shall be the sole judge with respect to interpretation of specifications or intent and conformance of substitute equipment or materials. In no case will alternates be accepted which increase the contract costs.

1.4 EXPERIENCE QUALIFICATIONS

A. Experience Qualifications: The Contractor to be engaged under this contract shall have a minimum of five (5) years continuous experience in the construction, furnishing, and installation of equipment, and startup and balancing of systems of swimming pool projects comparable in scope to this. He shall furnish written evidence of satisfactory completion of at least five (5) pools comparable to the type specified hereunder which have been operating satisfactorily for at least two (2) years. The Owner reserves the right to reject the proposal of any bidder who fails to meet the qualifications stipulated herein. The Owner also reserves the right to accept the proposal of a bidder who, in their current entity, does not meet these experience qualifications, but whose principals and officers can demonstrate, through previous experience the ability to complete this work satisfactorily.

C. The foreman for the work performed under this section shall be capable of performing the work described and able to show successful experience for five (5) years on installation of pools of similar scope.

1.5 SUBMITTALS

A. Submittals of Drawings:

1. Within 10 days of pool meeting called for in item 1.2 B. Description of Work, and prior to commencement of work hereunder, the Contractor shall submit to the Architect six (6) sets of detailed drawings (fully compliant with requirements of submittals under Sections 013300 and 131500), hydraulic calculations verifying pipe sizes and pump selections required for proposed system, equipment lists and catalog cuts for the work, materials and

equipment he proposes to furnish. Drawings shall clearly indicate layout, dimensions, reinforcing schedules, thickness' of materials, and limits of work under this contract.

2. The Contractor shall provide, prior to beginning any work, a complete shop drawing consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams and other information to illustrate the requirements and operation of each system. The Contractor shall provide detail drawings for the complete circulation, filtration, chemical control, make-up water, etc. systems. Drawings shall include piping layouts and locations of connections, dimensions for roughing -in, foundation and support point; and schematic diagrams and wiring diagrams or connection or interconnection diagrams. Detail drawings shall indicate pipe sizes, inverts, flow rates and clearances required for maintenance and operation. All valves shall be located and numbered.

3. No work shall be performed until the drawings have been approved by the Architect and necessary Government agencies. Approval of these drawings in no way relieves the Contractor of the responsibility to satisfy the intent of the specifications. Drawings submitted as "not to scale" will be summarily rejected.

4. In addition, complete shop drawings and equipment catalog sheets along with the required permit application forms, shall be submitted to the State Health Department and any other Government agencies having jurisdiction by the Contractor for approval before any work under this section may proceed.

5. Upon request, a full-size, 12" wide sample of the recirculating gutter system proposed must be submitted to the Architect, for his inspection and approval. A detailed drawing of the proposed gutter shown mounted on this project's pool wall must be submitted along with the sample section.

    a. The drawings must clearly indicate structural details and all dimensions including depth and cross-sectional area of drainage channel around perimeter of pool, and size and location of rope anchors and mounting brackets. Position of overflow lips shall be indicated with respect to pool water level, finished pool wall and finished deck level. Position of curb lip shall be shown with respect to finished level of adjacent deck. (Drawings furnished as "not to scale" will not be considered as meeting this requirement.)

6. Submit a sample of each test report form for approval prior to beginning pool installation. All test reports must be submitted on approved forms.

7. After completion of work, submit to Owner, manufacturer's written instructions for operation maintenance, and cleaning of all furnished items.

8. After completion of work, submit to Owner record drawings as called for in other sections of these specifications

1.6 WARRANTIES

A. POOL SYSTEM WARRANTIES

1. The Contractor shall warranty the stainless steel gutter and recirculation system, the pool filtration system and pool structure against defective materials and workmanship for a period of five (5) years. The Contractor shall warrant that the pool system, if operated in accordance with written instruction delivered to the Owner, shall meet all Federal and State requirements. Other items of equipment not listed below, shall be warranted by the appropriate manufacturers for a period of one (1) year from date of substantial completion.

   A five (5) year written warranty of the system components listed below is required as a part of this contract. Responsibility for the five (5) year warranty of the system rests solely with the manufacturer; therefore, the system must be furnished and installed by a single manufacturer. Installation by other than factory-trained employees of the manufacturer or systems which are supplied without installation shall not be approved. The five year system warranty shall include the following components:

   a. Stainless Steel Gutter and Main Drains
   b. Butterfly Valves, 4" or larger
   c. Filter Tank face piping.
   d. Hair and Lint Strainers
   e. Pumps and Motors
   f. Automatic water level control system
   g. Chemical Controller
   h. Concrete Pool Shell
   i. Interactive water features
   j. Interactive water play controllers and manifolds
   k. Waterslide
   l. Diving Boards

2. The Contractor shall provide a manufacturer's warranty for the aquatic climbing walls as follows:

   a. Panels: 2-years
   b. Frames: Lifetime of Installation

1.7 LEAK TEST REQUIREMENTS

A. A leak test must be performed on the pool and surge tank in accordance with the following test requirements. All initial filling and draining is by the Contractor with water paid for by the Contractor. If any structure leaks, it shall be repaired or replaced, and retested according to the same requirements. Leak tests shall be performed prior to the painting of the pools.

B. On the pool and surge tank, the Contractor shall perform a 48 hour leak test to be supervised by the Architect/Owner.

C. Structures shall be filled with water and allowed to stand for 24 hours. The Contractor and Architect shall then mark the level of the water in the respective structures. Twelve hours later

the water level shall be checked by both parties. If said level is found not to have dropped more than 1/4" during the 12 hours standing period, the Contractor shall certify in writing with copies to the Architect, that the structure appears to be watertight. The Contractor shall provide a "Control Body of Water" located on the pool deck for the duration of the test, in a leak proof vessel of known surface area for the purposes of establishing an evaporation rate, which the Architect will factor in to the evaluation of leak test.

D. Should water level be found to have dropped more than 1/4", the structure shall be left standing another 12 hours and the loss measured. If the level has continued to drop in this ensuing 12 hour period, the structure(s) shall be emptied by the Contractor. The Contractor shall proceed to locate the source of the leak(s) and cause for same to be repaired. The offending structure shall then be retested until it tests watertight as noted above.

1.8 PATENTED MATERIALS

A. The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for the infringement of any patent rights and shall save the Owner and the Architect harmless from loss on account thereof, except that the Contractor shall not be responsible for all such loss when a particular design, process or the product of a particular manufacturer or manufacturers is specified. If the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly notifies the Owner of Architect. The Contractor shall bond the indemnity required by this paragraph.

1.9 RESPONSIBILITY FOR THE WORK

A. The Contractor shall clearly define work limits and responsibilities to ensure timely completion of the work and an orderly construction process.

B. The Contractor shall carefully review the work of all sections of these specifications, to verify that all items are included. It is the responsibility of the Contractor, to make sure that all items necessary are included and provided to provide a fully functioning system. Any conflicting requirements shall be resolved by the Contractor.

1.10 RELATED POOL REQUIREMENTS

A. Submission of all data required to gain approval by regulatory agencies prior to, and following construction for the swimming pool structure and its equipment. The Contractor shall be responsible for code compliant installation of the swimming pool structural and mechanical systems and the equipment supplied under Division 13.

B. Verification of pool layout from bench mark and corner location.

C. Supervision of excavation and labor for hand trimming as required.

D. Coordination of all form work, embeds, and penetrations as required for pool and spray deck construction. Contractor must review topographic elevations to determine where form work inserts, penetrations, and accessories will be required.

E. Coordination and installation of reinforcing steel as specified.

F. Application of interior pool finish including furnishing and installation of special coating (painted) racing lane markers, wall targets, and depth markings as specified.

G. Furnishing and installation of gutters, main drain fittings and all pipe, fittings, and valves for the pool re-circulating system to and from the pool, to and from the surge tank, to and from the filter/chemical systems, and to and from the pool gutter system, and pool inlets.

H. Provision and installation of filtration and chemical/sterilization treatment systems.

I. Furnishing and installation of hydrostatic relief system.

J. Furnishing and installation of removable stainless steel railings as shown on the drawings.

K. Furnishing and installation all items of deck equipment and pool safety and maintenance equipment. Furnish and supervise installation of all anchors to be embedded in the deck.

L. Furnishing and Installation of (fresh water) automatic pool water level control system complete.

M. Furnishing and Installation of static fill line to surge tank.

N. Providing common electrical ground bonding of pool and structure(s), stainless steel perimeter system, pool fittings, and deck equipment in accordance with Division 26 and the National Electrical Code, (latest edition).

O. Furnish and install electrical control devices for pump motors, motor starters, level control devices, including required solenoid valves, electrical relays, etc. as specified or required.

P. Providing startup, balancing, and instruction service upon completion of work and furnish operating instructions and maintenance manuals to Owner (minimum four copies).

Q. Providing all pool testing and cleaning equipment.

R. Furnishing and installation of all equipment and materials as shown, specified and/or required for all pools, including features and equipment.

S. Installation of Pool Deck depth markings and "Warning" markings in pool deck at locations shown on the drawings.

T. Furnishing loose wall sleeves for installation in watertight concrete surge tank and sleeves in cover slab for reach rods. Sleeves shall be PVC no-leak flanged pipe nipples. Piping shall be watertight in these sleeves with the use of no-leak fittings cast in place.

U. Furnishing and installation of all surge tank valves, controls, etc., to result in a functioning surge tank.

V. Obtaining of final acceptance by Connecticut Health Department and all other governing jurisdictions.

1.11 RELATED GENERAL CONSTRUCTION REQUIREMENTS

A. Pool layout, bulk excavation and disposition of material. Dewatering and pumping of excavation as required. Fill materials as specified or required.

B. Concrete footings, foundation walls, deck slabs, and pavement.

C. Backfill of pool shell and concrete decks and equipment.

D. Water tight concrete surge tank and holding tanks. Furnish supply and install access hatchway frame and cover.

E. Concrete pads as required for pumps, equipment, etc., and cutting and patching of concrete walls or floors as required for piping.

F. Pipe trenches and backfill.

G. Sealants.

H. Waterstops.

I. Initial filling of pool at completion of construction. Water to be paid for by the Contractor.

J. Fittings and anchors required to be embedded in concrete work.

1.12 RELATED PLUMBING REQUIREMENTS

A. Fresh water supply piping for pool fill and water level control.

B. Waste water piping from the filter room to sanitary sewer piping.

1.13 RELATED ELECTRICAL REQUIREMENTS

A. Wiring to all items of pool equipment.

B. Wiring of automatic water level control.

C. Grounding of pool gutter, steel reinforcing, and all deck equipment in accordance with N.E.C. (latest edition) and Division 26.

1.14 SYSTEM TRAINING

A. A qualified representative of the Contractor, pool sub-contractor and equipment manufacturer performing work under this section shall put the equipment into operation and instruct the Owner's representative in the operation of this equipment to the Owner's satisfaction prior to substantial completion. The operations and maintenance manuals, specified in Article 1.15 shall be distributed at this training session and shall be reviewed by all parties.

B. A minimum of two days (16 hours) of start up instructions and demonstration must be provided to Owner's representative in the operation of pool and spray deck equipment, with an additional 48-hours of visits to be provided as requested by the Owner over a one-year period.

C. The initial 16 hours of training and demonstration shall include, but not be limited to, instruction on the following procedures:

1. Pool start up
2. Typical pool operation
    a. filter operation, including backwashing
    b. pump and strainer operation, including daily cleaning of strainers
    c. valve settings and operation
    d. guage and meter reading and operation
3. Chemical control system operation
4. Automatic water fill system operation
5. Spray Equipment operation, including manifold settings and controllers
6. Complete winterization procedures

D. The subsequent 48-hours shall include returning to the site at an appropriate time to instruct and demonstrate the winterization of the pool following construction and the start-up and winterizing of the pool prior to and after the 2015 swim season.

1.15 OPERATIONS AND MAINTENANCE MANUALS

A. Two weeks prior to the start-up and instruction specified in Article 1.14, provide a draft copy of the Operations and Maintenance Manual to the Architect for review and comment. The Architect shall provide comments to the Contractor within one week. The Contractor shall provide two final copies of the manuals to the Owner and one final copy to the Architect at the time of the training.

B. Operations and Maintenance Manuals shall be provided as specified in Section 017823 and as herein specified. Manuals shall be bound in a three ring binder, with the project identified on the front and edge. The manuals shall be organized in tabbed sections, including, but not limited to, the following.

1. Project Directory
2. Project Description
3. Narrative System Descriptions and One Line Diagrams
4. As-Built Drawings of pool piping and equipment, inclusive of flow indicators and valve tags
5. Valve tag chart, indicating position of each valve for each mode of operation
6. Operating instructions for each pool component and system
7. Start-up Procedures
8. Backwash procedures
9. Winterization procedures
10. Equipment manuals with maintenance instructions

1.16 MAINTENANCE SERVICE

A. At the time of Substantial Completion, the Contractor shall provide a proposal to the Owner for full maintenance service by skilled, competent employees for 2 years following date of project substantial completion. The proposal shall include shut-down and start-up maintenance, performed during normal working hours on dates mutually agreeable to Owner and Contractor. Include repair and replacement of worn or defective parts of components and lubrication, cleaning, and adjusting as required for proper system operation in conformance with specified requirements. Exclude repair/replacement due to misuse, abuse, accidents or neglect caused by persons other than Installer's personnel.

B. A report shall be issued to the Owner indicating type of tests and system status within seven (7) days following visits.

C. The Installer shall be able to show that he has had successful experience in the complete maintenance of pool systems, employs trained and competent maintenance of pool systems, employs trained and competent personnel to handle this service, maintains locally an adequate stock of parts for replacement for emergency purposes and has qualified men available at such places to ensure the fulfillment of this service.

PART 2 – PRODUCTS - Not Used

PART 3 – EXECUTION – Not Used

END OF SECTION 131000

SECTION 131500 - SWIMMING POOL SYSTEMS and EQUIPMENT

PART I GENERAL

1.01 Related Documents

Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to the work specified in this section.

1.02 Scope of Work

A. It is intended that the labor and materials of this section shall be provided by a single manufacturer, or, where products are not available, the manufacturer shall provide such equipment and shall be solely responsible for a properly integrated system of components, materials, and workmanship which will conform to the requirements of these specifications and established codes and standards of the industry.

B. The work of this section shall include, but is not necessarily limited to the following:

1. Provide prefabricated stainless steel perimeter recirculation systems.
2. Provide filter systems, recirculation systems and chemical treatment systems as shown on the drawings and as herein specified.
3. Provide all pool fittings and valves as shown on the drawings, and as required to form complete recirculation system for pool.
4. Provide all swimming pool specialty equipment, including deck and safety equipment as herein specified.
5. Provide all amenities, water play features, structures and systems as herein specified and as shown on the drawings.
6. Full coordination with other trades, not specified in this section, but necessary for the complete operation of the swimming pool systems, including pool structure, plumbing and electrical requirements.

1.03 Related Work Specified in Other Sections

A. Section 032500, Concrete Waterstops
B. Section 033300, Cast-in-Place Concrete
C. Section 055050, Pipe Hangers and Supports for Swimming Pool Piping
D. Section 055220, Stainless Steel Pipe and Tube Railings
E. Section 071616, Crystalline Waterproofing
F. Section 099600, High Performance Coatings
G. Section 101400, Signs
H. Section 220000, Plumbing, General
I. Section 260000, Electrical, General
J. Section 131000, Swimming Pool General Requirements

1.04 Pool Equipment Manufacturer's Qualifications

A. At least five years' experience in the equipping of public swimming pools. Refer to Section 131000 for specific requirements.

1.05 Codes and Standards

A. State of Connecticut Public Swimming Pool Design Guide.
B. State of Connecticut Building Code.
C. NSF Public Pool Equipment Standards.
D. United States Swimming, Inc. Facilities and Equipment Standards.
E. NCAA, Latest Edition, Standards for Diving Facilities
F. Virginia Graeme Baker Pool and spa Safety Act
G. ASME A112.19.8-2007

1.06 Responsibilities and Limits of Work

A. The Manufacturer shall clearly define in his/her bid, all components furnished under this Contract.

PART II PRODUCTS

2.01 General

A. All products, equipment, hardware and materials furnished shall be by manufacturers with at least five years' experience in the production of the item(s) provided.

B. All products and materials furnished shall be certified by the manufacturer(s) or listed by established testing agencies (NSF, UL, etc.) as suitable for use on public swimming pools.

C. All materials shall be resistant to corrosion by chlorinated pool water.

2.02 Prefabricated Stainless Steel Perimeter Systems

A. Available Manufacturers: Products that may be incorporated into the Work include:

1. Neptune Benson, Inc. (Basis of Design)

a. Typical Gutter VCRS 12 x 12 – Semi-recessed-6" deck to water level.
b. At zero-depth entry: VCRS-12x12-Deck Level-0" deck to water level.
c. At sides of zero-depth entry, extend stainless steel curbs from water level to deck level.

2. Natare
3. Paddock

B. Materials

1. Fabrication

   a. Overflow channel, T304L stainless steel, 12 gauge.
   b. Supply header, T304L stainless steel, 12 gauge.
   c. Channel covers, Fiber composite T-Bar grating with non skid surface and UV protection. Provide bearing capacity 300 pounds per square foot.
   d. All anchors stainless steel.

2. Filtered water supply converter and header to accommodate specified recirculation rate(s) at velocity not to exceed 10 FPS, and pressure of 35 psi without distortion or deflection.

3. Inlet fittings not more than 15 feet apart, centered between swim lanes, and sized to assure exit velocity not greater than 15 FPS.

4. All joints welded and finished to match adjacent surfaces.

5. Recessed stainless steel rope anchors as required for lane lines and safety float lines. Gutter to be reinforced at all recessed anchor locations.

6. Channel covers around entire perimeter, slip resistant finish, non corrodible tamper proof fasteners, 300 PSF bearing capacity.

7. Overflow lip formed to provide an acceptable “hand hold” around pool perimeter.

8. Supply and drain converters with stainless steel pipe stubs sized to accommodate specified drainage flow at maximum 3 FPS velocity and specified supply flow at maximum 10 FPS velocity.

9. Coordinate control relay, solenoid valve and wiring diagram for installation of automatic water level control components by plumbing contractor and electrical contractor.

10. Depth markings and “no diving” warnings as required by state regulations and indicated on the drawings.

2.03 Pool Fittings: Main Drains

A. Available Manufacturers: Products that may be incorporated into the Work include:

1. Neptune Benson, Inc. (Basis-of-Design) Model No. 242424SSMD-AE-8
2. Natare
3. Paddock

B. Bottom drain sumps (3 required)

1. Materials

a. Three drains, each a minimum of 24”x 24”x24” deep, twelve gauge T304L stainless steel with 8” flanged connection.
b. Twelve gauge x 3”, fully welded waterproofing flange.
c. Provide fiberglass Aegis Anti-Entrapment Shield.
d. Corrosion resistant tamper proof fasteners.
e. Fitted for standard 125 pound ASA flange connection.
f. Bronze hydrostatic relief valve with Schedule 80 PVC underdrain laterals.

2.04 Surge Tank Fittings

A. Available Manufacturers: Products that may be incorporated into the Work include:

1. Neptune Benson, Inc. (Basis-of-Design)
2. Natare
3. Paddock

B. Bottom Drain Modulating Valves

1. Neptune Benson: NBR6FL10
2. Dual float arm type. Housing body fabricated from Schedule 80 PVC pipe with Schedule 80 PVC van stone flanges.
3. Internal wafer to be 12 gauge, T304L material and positioned to have 1/8” clearance around perimeter of disc.
4. The body shall incorporate an interior stop plate constructed of PVC to define the allowable range of arm motion. Close fitting Delrin bushings shall be included on the shaft penetrations of the body to provide a seal against water loss and air entrance.
5. Valve shaft to be T304L stainless steel, 1” diameter of adequate length to house two float arms. Provide T304L sliding collars, pins and ½” diameter float arms.
6. Ball floats shall be constructed of T304L stainless steel and be 7” in diameter with internal weighting. Floats shall be adjustable using T316SS nuts and washers.
7. Assembly shall be constructed to be water and air tight, at all shaft penetrations.

C. Anti-vortex Plates

1. At Pump P1: Neptune Benson AVPLATE10PVCKIT; T304 stainless steel, 12 gauge –or- PVC, for attachment to standard ASA flange on 10-inch diameter pump suction pipe.
2. At Pump P2: Neptune Benson AVPLATE8PVCKIT; T304 stainless steel, 12 gauge – or- PVC, for attachment to standard ASA flange on 8-inch diameter pump suction pipe.
3. At Pump P3: Neptune Benson AVPLATE25PVCKIT; T304 stainless steel, 12 gauge –or- PVC, for attachment to standard ASA flange on 2 ½ -inch diameter pump suction pipe. Provide 2 ½ x 1 ½ concentric reducer to reduce to 1 ½-inch suction pipe.

2.05 Pool Filter

A. Available Manufacturers: Existing pool filters, relocated from existing Bathhouse shall be relocated and reused at new pool. Remove sand filter media prior to the relocation of the filters. Once sand is removed, inspect, with Architect, the laterals and filter fittings to ensure they are not damage. Once relocated, provide new filter face-piping and sand media. Specifications below indicate existing filters, and required, new face piping and filter media.

1. Neptune Benson, Inc. (Existing to be relocated)

a. (2) 6096SHFFG-3WGO-8X6 WOW High Sand Fiberglass Filter Tanks
b. Filter Gauge Panel Model GAUGEPSTDR1 with 6” Pipe Mount and connection kits. Provide new tubing.

B. Fiberglass Swimming Pool Filters Equipment (New):

1. Sand Bed Area:

a. Uniformly graded silica sand as recommended by filter manufacturer. Free from appreciable quantities of foreign material, and the particles shall be round or angular, not flat or elongated
b. 1/8” x ¼” Gravel – 20 cubic feet per tank
c. .45mm - .55 mm Sand – 80 cubic feet per tank.

2. Filter Face Piping and fittings:

a. Face Piping Assembly: Neptune Benson (No substitutions): FPSH-8x6 FACEPIPE STD 2SHF 8X6 PVC SCH 80 DOM VALVES
b. Single Lever Linkage: SLM-8 LINKAGE SINGLE LEVER MANUAL 8” DOMINION VALVES with 521060LLVR LEVER HANDLE 6-8”DOM 6” VIC

2.06 Swimming Pool Pumps:

A. 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:

1. Griswold Industrial Pumps
2. Marlow, ITT Fluid Technology Corporation. (Basis of Design)
3. Starite Industries.

B. Pumps

1. Pump P1; Main Recirculation Pump: (Existing to be relocated) Marlow Pump Series 530SC. Pump. 25 HP, 1750 rpm, with 9.75" diameter impeller. Pump to operate at 1,200 GPM at 65 FTDH. Salvage for reuse 8 x 5 stainless steel concentric reducer at pump discharge.
2. Pump P2; Slide Feature Pump: (New) Marlow 530-5-7SC; 10 HP, Pump speed and impeller size as required to provide 750 GPM at 35 FTDH.
3. Pump P3: Water Feature Pump: (New) Pentair Intelliflo VS+SVRS variable speed pump. Pump to provide 24 GPM at 50 FTDH.

2.07 Strainers

A. Strainers

1. Pump P1; Main Recirculation Pump: (Existing to be relocated) Fluidtrol Model RSW116110631' 10 x 6. Salvage and relocate (2) stainless steel baskets.
2. Pump P2; Slide Feature Pump: (New) Neptune Benson 150NBSTL06 STRAINER H&L GUARDIAN 6" T304SS FLGD.
3. Pump P3: Water Feature Pump: Integral with Pump P3.

2.08 Chemical Control Systems

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the products of Pulsar; System 500; Model PS 500.

B. Swimming Pool Chemical Control System:

1. Chlorine Feed System:

a. The chlorine feed system specified under this section shall be capable of feeding 486 pounds of available chlorine per day at 100% output, into the recirculation system of the swimming pool for the purpose of maintaining a chlorine residual at a preset limit. The specified system shall work in concert with an automatic water chemistry control device, which shall govern the feeding of chlorine.

The chlorine feed system, specified herein, will be the standard cataloged product of a company regularly engaged in the manufacture of such devices for use on public and institutional applications and shall be listed by NSF under Standard 50.

b. Chlorinator:

1) The chlorinator shall be equivalent to Pulsar system 500, made of non-corrosive material. The unit shall incorporate the following major components: electrical control console with failsafe shutdown and alarm sensor, structural support mounting base, 62 lb. chemical Storage Hopper with gasketed lid and hold-downs, feed engine consisting of Activation Jets and Chamber, and a Fluidizer assembly. The chlorinator shall operate in a non-pressurized manner to ensure optimum safety and ease of operation.

2) The chlorinator shall be designed to utilize dry calcium hypochlorite in the briquette/tablet form having 65% available chlorine, minimum, with 0.4 to 0.6% scale inhibitor (by weight). The chlorine utilized shall provide even dissolution rate for uniform chlorination of the swimming pool.

3) Calcium hypochlorite briquettes/tablets shall enter a conical shaped activation chamber via a product storage hopper. High-pressure water, introduced through a series of activation jet fittings, shall provide for controlled decomposition of the calcium hypochlorite, converting the dry chemical into a chlorine liquid concentrate. The concentrate liquid shall flow from the activation chamber into a fluidization chamber. The contents of the fluidizer, concentrate chlorine liquid, shall be drawn, under vacuum, into the recirculation plumbing by a venturi/eductor. Outlet shall operate within a vacuum range of 1” to 29” Hg.

4) The chlorinator shall operate with supply water pressure between five- (5) and thirty- (30) psig, and a flow rate of one and one half- (1½) gallon per minute. Each feed device shall be 22 ½” x 25” x 40” (W x L x H). Two units will be utilized (one for pool and one for spa).

c. Mounting Base: A single piece molded structural-mounting base constructed of non-corrosive FRP shall be provided. The base shall be drilled and inserted to receive all major components. The base shall be drilled to receive anchor hold down bolts and shall be suitable for seismic zone 4 installation. Four (4) 3/8” x 3 1/2” anchor bolts with nuts

and washers for securing the unit to the mechanical room floor shall be supplied.

d. Manifold Assembly: Influent and effluent manifolds will be provided. Influent will receive 3/8" tubing and effluent will receive 5/8" tubing. Shutoff valves will be provided. The assembly shall include all necessary tubing and compression fittings for connection of the feeder to and from the recirculation plumbing.

e. Electrical Control System:

1) Enclosures:

a. The electrical control system will be housed within a separate non-metallic NEMA 4X enclosure. The enclosures shall be provided with weather proof sealing gaskets.
b. The electrical control system will be mounted directly to the chlorine feed system.

2) Solenoid Valve: An industrial grade stainless steel normally closed solenoid operated valve will be mounted into the inlet water line. The solenoid valve will be 115 VAC and will be controlled by an automatic pH/HRR controller.

3) Enable/Disable Switch: A switch shall be mounted into the cover of the electrical control system. The switch will allow for the system to be enabled or disabled, enabled meaning feed events will be dictated by a timing switch or an automatic water chemistry controller, disabled meaning no feed event will be allowed.

4) Shutdown and Alarm: A non-wetted water level sensor shall be provided to monitor the water level in the activation chamber. Water level exceeding design allowance will initiate an alarm and will shutdown the feed of chlorine.

5) Indicator Lights: Indicator lights (LED) will be mounted in the cover of the electrical control system enclosure. The light shall indicate the status of power, alarm condition and feed mode.

f. Injector with Booster Pump Assembly:

1) MTS Injector: A (MTS) mass transfer system ram style venturi/eductor, will be utilized to inject the chlorine into the swimming pool recirculation system. Schedule 80 PVC fittings will be provide for injector to pump hook-up. The injector will be made of polyproplene. Injection by means of connection to pump suction will not be acceptable.

2) Booster Pump: The pump housing will be made of non-metallic, corrosion resistant materials. A mechanical seal will be provided between the pump

housing and the motor. The seal will be a precision lapped, highly polished carbon-ceramic stainless steel shaft seal. The motor will be a 3/4 HP, single phase, 110 VAC, 60 cycle, and 3450 RPM. The motor will be a NEMA 'C' face flange mounting with a drip proof enclosure. The motor will be equipped with sealed ball bearings to provide for smooth, quiet operation. A fiberglass channel pump/motor support bracket with anchor bolts will be provided

g. Chemicals: Provide all necessary start-up chemicals. Once water is chemically balanced, provide an additional four (4) 62lb canisters of approved calcium hypochlorite briquettes/tablets for start-up and initial operation

h. Accessories: Provide all necessary accessories, including, but not limited to the following:

1) Foot Valve
2) Anti-siphon Valve
3) Suction Tubing
4) Discharge Tubing
5) PVC Sleeves for Tubing
6) Injection Nozzle
7) Flow Switch

2.09 CO_2 Feed Systems for pH Control (Existing to be relocated)

A. System is to be relocated from existing pool, inclusive of the following:

a. CO_2 system, Auto-switchover: Lincoln Catalog #09-045. With automatic switch-over regulator with pressure gauges, cylinder hoses. Provide new tubing and fittings.
b. TEK CO_2 feed unit with Solenoid: Lincoln Catalog #09-085.
c. CO_2 Diffuser with Check Valve: Lincoln Part # 09-060

2.10 Chemical Controllers

A. Pool Controller: Provide the following (No Substitutions):

1. Provide ProMinent DCM 5 Controller.

B. Controller shall be interlocked with the filter pump motor. When the pool circulation goes down- all chemical feeds shall go down. Interlock the controller to disconnect filter pump, jet pumps, UV system and chemical control system in the event of a pump failure. Unit shall also be capable of the following:

1. The controller shall be capable of testing both sanitizer residual and pH on a separate and independent basis. Treatment must also be activated on a separate and independent basis. There must be a continuous communication between the pH and the ORP existent within the singular modular circuitry. The controller must be capable of monitoring temperature.

2. Controller shall be complete with flow cell, electrodes, tubing, fittings and Teflon tape. Provide all labor and materials required for a complete installation.

3. Sensors:
    a. pH
    b. ORP
    c. Temperature
    d. Free Chlorine

4. Control to be as follows:

    a. On/Off
    b. ORP assisting risidual
    c. P/PI/PID
    d. Intelligent Control
    e. Eco Mode
    f. Event Timer
    g. Chlorine Boost
    h. Flow Restored Delay (adjustable)
    i. Emergency Off for Recirculation Pump
    j. Autofill
    k. Chemical Feed Verification

5. Communication to be as follows:

    a. HTML server on board, standard
    b. 10Base T, TCP/IP Ethernet, Wireless EVDO Cellular, Smartphone/I-Pad/Tablet
    c. HTML, Micro Web Server with user definable IP address

6. Emergency notification via modem, fax or phone of owner designated personnel when the system is not performing within parameters.

7. Operator interface shall include the following:

    a. Remote: Fully interactive Ethernet TCP/IP graphical interface with security access codes.
    b. Local: 2 Line, 12 Character LCD Display, 5 buttons, 2 LEDs: Steady Blue = “OK”, Flashing Blue = flow switch is in “Recovery Delay” after a flow interruption, Flashing Red – Alarm.

8. Inputs:

    a. 8 Digital Inputs with 7 fully configurable
    b. 8 Analog Inputs (configurable)

9. Outputs:

    1. Control Relays: 5, fully assignable. Interlocked with sample and recirculation flow when used for chemical feed.
    2. Digital Outputs: 4, fully assignable as dry contact sets. Base Feed to be accessible if sensor is disconnected.
    3. Analog Outputs: 2, isolated, 4-20mA.

10. System:

    1. Power: 120 VAC, 50/60 Hz, single phase
    2. Fusing: 5 amps @120 VAC
    3. Surge Suppression: Relay 2-5 N.O. contacts snubbed @ 0.1 uF, 150 ohm
    4. Accessory Power: 15-22 VDC, Unregulated, Thermally Fused @50mA
    5. Enclosure: Non-metallic, NEMA 4X; 7.5" x 11.3" x 5.5" (WxHxD)
    6. Convenience:

        a. Save and Restore of "last known good" parameters.
        b. Multiple pre-loaded configuration and browser views.

11. Coordinate all electrical requirements and provide necessary materials and licensed electrical labor for the complete installation of the specified system.

2.11 Automatic Pool Water Level Controller

A. Provide the following:

    1. Neptune Benson: WLC-200 (No Substitutions)

B. Provide all required components for a complete automatic pool water level control system. Controller system shall be readily accessible for maintenance and operation. Each system shall include, but is not necessarily limited to, the following:

    1. Controller package shall consist of a bracket-mounted 3-probe housing, 3 stainless steel probes, a 2" clear plastic probe chamber with mounting clamps, a control panel housing a liquid level relay, a delay timer and a 110 volt, 24-hour timer. All controller components and housing shall be U:L Listed.

    2. Water level shall be controlled by the use of a three probe electrode system; high level, low level and ground.

    3. Probes shall be housed in a hard thermoplastic housing that is mounted to a stainless steel bracket by a ¾" bulkhead fitting. Stainless steel probes are to extend into a clear 2" water level reflecting chamber that is mounted below the probe housing with

clamps. A 2" PVC line shall be connected to the bottom of the clear chamber from the pool wall to reflect the water level in the pool.

4. Wiring from the probes shall be connected to the relay that is to be mounted within a non-metallic, NEMA 4X enclosure. The enclosure size shall be no less than 8" wide x 10" high x 5" deep. The access door shall be the entire front face of the enclosure with a vertically mounted stainless steel hinge equal to the full height of the door. Stainless steel hasps with locking loop latch shall be permanently secured to the enclosure. The enclosure shall be mounted in the Filter Room and conduit and wiring shall be coordinated.

5. Mounted within the enclosure shall be a liquid level relay, adjustable delay timer, 24 hour clock/timer and terminal board. Major components shall be plug-in type for instant replacement without wiring. Unit shall be suitable to activate any 110 volt circuit for solenoid valve for providing make-up water.

6. All wiring shall be made through the bottom of the enclosure.

7. Solenoid valves shall be slow-closing and sized as indicated on drawings. Solenoid valves to have BC6 bronze alloy body with NBR, Nitrile Rubber seals. Plunger and pole piece, plunger tube and springs to be stainless steel. Shading coil to be copper.

2.12 Pool Piping, Fittings and Valves

A. Piping

1. Buried and embedded piping Schedule 80 PVC.
2. Exposed piping Schedule 40 PVC.
3. All joints socket weld or flanged.
   Connections to threaded fittings by socket to thread adapters -- threaded pipe will not be accepted.

B. Fittings

1. Provide flanged connections or "spool pieces" as required for easy removal and replacement of system components.
2. Stainless steel bolts for immersed flanges; cadmium bolts for all others.
3. Provide hangers, supports and thrust blocks as required to prevent excessive vibration of piping and stress on joints.

C. Operable Valves

1. Non-immersed valves larger than 2 inches shall be wafer type "butterfly" valves with cast iron body, stainless steel shaft and pin, aluminum bronze disc, and "buna-N" seats and liners.
2. Non-immersed valves 2 inches or smaller shall be bronze gate valves.
3. Immersed valves shall be PVC wafer valves with stainless steel shafts and pins.

4. Surge tank wafer valves shall be fitted with stainless steel handle extensions to deck boxes above.

D. Check Valves

1. Wafer style, T304H, stainless steel, equivalent to Ocean International Suppliers

E. Pipe and Valve Identification

1. Piping System Identification:

a. Pipe markers shall be either: pre-printed, semi-rigid snap-on, color coded plastic pipe markers - or pre-printed, permanent adhesive, color-coded, pressure sensitive vinyl pipe markers. Include arrows to show direction of flow. Markers shall be located on piping at Filter Rooms, Surge Tanks, Holding Tanks, Valve Boxes and Drainage Structures.
b. Locate pipe markers and arrows as follows:

1. Near each major equipment item, valve and control device.
2. At pipe runs at a maximum of 12 feet on center.
3. Near each branch.
4. Near locations where pipes pass through walls or floors/ceilings or enters non-accessible enclosures.
5. At access doors, manholes and similar access points which permit views of concealed piping.
6. Near points of origination and termination.

2. Valve Identification:

a. Valve tags shall be 1 1/2” diameter, 19 gauge polished brass with stamp engraved lettering. Coordinate numbering with Division 15 so no two valves have the same numbers.
b. Provide valve tags on every valve, cock and control device in each piping system. Exclude check valves and valves installed in factory fabricated equipment units. List each tagged valve in valve schedule for each piping system. Coordinate with Division 15.

F. Single Action Backwash Control

1. A clevis and rod linkage shall connect the butterfly valves required to be operated to switch from filter mode to backwash mode. Linkage shall be assembled such that the pool lever arm can be raised or lowered, causing the mode of operation to change with a single action.

2. Linkage shall be assembled by a series of stainless steel clevis’ and pins. An operating handle shall be secured to the system for operation.

3. Linkage shall be fully adjustable.

4. Linkage shall be designed so that all valves operate simultaneously, eliminating the possibility of water hammer. Each valve shall be adjustable to allow accurate positioning of valves.

2.13 Meters, Gauges and Miscellaneous Fittings

A. At filtration system and as shown on Drawings:

1. Flowmeter at each return line from Pumps P1, P2 and P3: Self powered analog type equal to Signet. Provide MK 515 Paddlewheel Flosensor and MK-5090 Self-Powered Analog Flowmeter - Calibrated in GPM. Range of calibration appropriate for flow rates. Install as required to have minimum upstream and downstream pipe diameters as recommended by manufacturer.

2. Combination Pressure/Vacuum Gauge at each Pump Suction: Equivalent to Neptune Benson #150707010C, 30”-0-100 psi.

3. Pressure Gauge at each Pump Discharge: Equivalent to Neptune Benson #150707040C, 0-100 psi.
4. Backwash Sight Glass: Equivalent to Neptune Benson #150156NBSGR1 for 6” Pipe.
5. Influent and Effluent Pressure Gauges: Relocated with existing filters.

H. One Meter Diving Board and Stand (2 required):

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. Duraflex International (Basis of Design)

2. One-meter diving stand shall be Dura-Firm Stand Catalog #70-231-4.

a. Stand shall be heavy cast-aluminum castings with TGIC polyester.
b. The roller and tracks shall be heat treated extruded aluminum, hard anodized. The bearings for the roller and slide shall be Teflon/polymer with grease path.
c. The diving board anchor hinges shall be heat-treated aluminum forgings with a design tensile strength of 35,000 psi and shall be hard anodized. Hinges shall be mounted on a transverse casting allowing a minimum of six (6) leveling positions in one (1) inch increments.
d. The diving board anchor bolts shall be 5/8” diameter by 3 ½ inches long stainless steel carriage bolts.
e. The diving stand shall be supplied with top and intermediate hand rails on two sides. The handrails shall be stainless steel tubing firmly

attached to the handrail supports with stainless steel rail clamps. The rails shall extend to the edge of the swimming pool and the rail ends shall be fitted with safety tips.

3. Anchors shall be Dura-firm Catalog Number 70-231-900.

   a. Provide eight Bronze Deck Anchors with integral means of bonding anchors to bonding and grounding system.

4. Aluminum springboard shall be 16 feet long by 20" wide, with the entire upper surface covered with non-skid surface. Duraflex Model Number 66-231-326.

   a. Board to be a one-piece ribbed extrusion of aluminum alloy 6060-T6, heat treated for a yield strength of 50,000 psi.
   b. Board to have a torsion-box extrusion, an anchor angle, and tip end cap riveted to the basic section.
   c. Board to be tapered from the fulcrum area to the tip.
   d. Board to be coated in aqua-colored thermal-curing epoxy resin. The top surface is to be finished with a flint silica and alumina, between coats of epoxy to effect a slip-resistant surface.
   e. The board is to be bolted to the diving stand with two (2) 5/8" diameter stainless steel carriage bolts (Durafirm #SF122 5/8" x 3 ½").
   f. The underside of the board is to be protected from direct contract with the fulcrum by means of rubber channels (8) attached to the board with epoxy adhesive.

2.14 Water Spray Deck Equipment:

A. Basis-of-Design Product: Products manufactured by Vortex Aquatic Structures International, are the referenced standard of quality. Subject to compliance with requirements, the only products that may be incorporated into the Work include products of the following manufacturers. No other substitutions will be considered.

   1. Vortex Aquatic Structures International, 328 Avro St, Montreal, Quebec H9R 5W5, 1-877-5VORTEX.
   2. Aquajeux International, Inc., 1709 Montee Ste-Julie; Ste Julie (Quebec), J3E 1Y2; - 888-441-2040.

B. The Basis of Design and equivalent items of water play equipment shall be furnished and installed in the project. All equipment shall be deck mounted within the pool or recessed equipment as detailed or specified. Anchor sockets shall be of stainless steel with flush mounted escutcheon plates. All anchorage shall be set in place by the Contractor. All anchorage shall be bonded in accordance with the National Electric Code. All accessories necessary for the proper installation and performance of the equipment specified shall be supplied whether completely specified or not.

See Drawings for Spray Feature Model Numbers.

C. Supplier shall furnish required components complete with all anchoring, fastening devices, required gaskets, base skirt and Interactive Valves.

D. Construction: the components shall be manufactured from stainless steel or other materials inert to pool chemicals. Where metal or steel is supplied as part of the feature all such parts shall be manufactured from 304 stainless steel. Mild steel components shall not be used regardless of rust preventive coatings.

E. Interactive Valve: shall be mounted in pipe and/or structural tubing so users can control water flow through orifices and outlets of the component. No external flanges or bolts shall be used to mount the valve.

F. Valve: shall be cast Aluminum ASTM S12A with seats of EPDM, stainless steel stem and nylon coated ductile iron disc. Interactive valve handle shall be soft polyurethane material.

G. Piping: and/or structural tubing shall be rigid, corrosion proof, stainless steel material with a smooth polished, powder coated finish. Coated components shall have a durable powder coat finish. Attachment flanges shall provide bolt-holes for mounting at the base of the pipe.

H. Gaskets: shall be neoprene closed cell material, 2 inch thick to allow minimal field adjustments for leveling.

I. Fasteners: shall be type 304 stainless steel for all anchor bolts, vitaulic couplings and fasteners. Anchor bolts for mounting to foundation shall be expansion type anchor bolts.

J. Spray heads and nozzles shall be stainless steel or brass.

K. Colors: Selected by Architect from manufacturer's full range of options.

L. Piping and Fittings: All piping and fittings shall be schedule 40 PVC. All factory-assembled components, fittings and connections shall be water pressure tested prior to delivery.

M. Electrical Enclosures, Conduit, Wiring and Connections: All electrical wiring shall be # 16 AWG with a 600V rating. All electrical connections, enclosures, and conduit shall be Nema 4x watertight.

2.15 Aquatic Climbing Wall:

A. SYSTEM DESCRIPTION: Deck-mounted artificial aquatic climbing wall features HDPE (High-density polyethylene) panel system in solid colors and clear panels, manufactured off site. Designed to withstand chlorinated environments.

B. Basis-of-Design Product: Products manufactured by Pyramide USA Inc., P.O. Box 530, Fredrick, MD 21705, are the referenced standard of quality. Subject to compliance with requirements, products that may be incorporated into the Work must be equivalent to the specified Basis of Design, and manufactured for safety in the specified pool depths and clearances.

1. Structure at east side of Deep Pool: Aquaclimb 'Classic Spirit" Model AC-C-S (4H, 3W) – 4 panels high by 3 panels wide, solid panels.

    a. Lower panel to be partially sub-merged and installed close to pool wall to prevent entrapment.
    b. Outer 30-inches of climbing wall, edge panels at both sides and top, will be blank, void of any foot or hand holds.
    c. Available climbing height is 13-fet, 1-inch. Total wall height above deck is 12-feet, 10-inches. Width of wall is 9-feet, 8-inches.
    d. Climbing wall to tilt inward towards pool with a distance of climbing wall plummet from pool wall of 2-feet, 6-inches.

2. Structure at west side of Deep Pool: Aquaclimb 'Classic Krystal" Model AC-C-K (4H, 3W) – 4 panels high by 3 panels wide, clear panels.

    a. Lower panel to be partially sub-merged and installed close to pool wall to prevent entrapment.
    b. Outer 30-inches of climbing wall, edge panels at both sides and top, will be blank, void of any foot or hand holds.
    c. Available climbing height is 13-fet, 1-inch. Total wall height above deck is 12-feet, 10-inches. Width of wall is 9-feet, 8-inches.
    d. Climbing wall to tilt inward towards pool with a distance of climbing wall plummet from pool wall of 2-feet, 6-inches.

B. Components:

3. Base: The aquatic climbing wall base shall be fabricated from 1-½"square tube with 0.120" wall thickness, grade 304 stainless steel with an epoxy texture powder coating, chemically resistant- developed for coating buried in-ground pool components . The maximum footprint of the base will be 32" from the pool wall onto the deck for wall heights designated as 2H, 3H or 4H and 38" for 5H walls.
4. Frame: The aquatic climbing wall frame shall be fabricated of 1-½"square tube with 0.064" wall thickness, grade 304 stainless steel with an epoxy texture powder coating, chemically resistant- developed for coating buried in-ground pool components. The main frame shall be vertical for the bottom 39" before extending at a 12 degree angle over the water for the remaining climbing area. The frame will then be vertical for a minimum of 25" at the top for the safety panel area. The bottom climbing panel(s) of the main frame shall be partially submerged and drops below the deck level by approximately 29". The main frame with panels attached extends approximately 3-¼" to 3-½"from the pool wall (no aquatic climbing wall materials may touch pool wall). The maximum gap between the pool wall and the backside of the AquaClimb frame must be no greater than 1-¼". Total width of each base section is approximately 40". An unlimited number of sections may be attached together to form a single wall.
5. Panels: Climbing panels are 1 meter x 1 meter (approx 39.3" x 39.3"),non-abrasive flat ½" thick solid-color HDPE plastic able to withstand UV and chlorinated environments. Standard climbing panel colors are blue and green. (Other color

options are available but may be an additional cost and require more time for production.) Safety panel(s) are flat ½" thick clear polycarbonate plastic, which is bevel cut and polished on all edges, with scratch resistant coating, able to withstand UV and chlorinated environments.

6. Holds: Climbing holds are non-abrasive polyester resin with UV inhibitors in aquatic colors. Hand holds are modular and can be rotated and/or moved to predrilled locations.
7. Anchors: Standard anchor system includes four 5/8"D x 6"L stainless steel mechanical wedge anchors per base section with a safe working load of 2075lbs/ea. Tightening torque is 90lbs per anchor. Additional anchoring options may be required for various types of gutter and coping configurations. This will be determined based on gutter details provided.
8. Fasteners: Climbing panels and holds are attached by grade 18-8 stainless steel through-bolts countersunk flush to surface.

2.16 Waterslide:

A. SYSTEM DESCRIPTION: Deck-mounted aquatic waterslide. Open-flume.

B. Waterslide to be equivalent to Standard Poolsider Model #MS-101 as manufactured by Whitewater West Industries, Ltd. Provide complete shop drawings for approval by Architect.

C. Refer to Drawings for additional information.

2.17 Pool Deck Equipment

A. Pool Ladders (Coordinate number of steps with pool depths)

1. Frames of T304 stainless steel tubing 1.9" O.D. by .109" thickness.
2. Step treads of 12 gauge T304 stainless steel, 18 inches by 3 inches with "non-slip" surfaces. Treads bolted to frame with stainless steel hardware.
3. All bends 6" radius, frames bent in at bottom and fitted with PVC bumpers to rest against pool wall.
4. All welds by inert gas process. Welds, corner and sharp edges ground smooth and polished to match adjacent surfaces.
5. Provide non corrodible anchors with grounding lugs.

B. Wave Quelling Lane Lines

1. Recessed anchors in gutter, fully reinforced and welded. Refer to Gutter specifications.
2. "Anti-turb" type equal to KDI Paragon, I.D. # 76106-1, 25 Yard.
3. Line Storage Reel equal to Recreonics Storline Reel #14-367, with cover.

C. Movable Lifeguard Chairs – (2 required) Provide recycled plastic, front step Guard Chair, equivalent to Champion Guard Chair:

   a. Provide (3) 50" Seat Height, Lincoln Aquatics Model Number 38-064.

D. Fixed Lifeguard Chairs – (9 required)

   a. Provide Paragon, Paraflyte Guard Chair, Lincoln Model #38-010.
   b. Provide with Fiberglass, swivel guard seat.
   c. Provide with holder for rescue tube and umbrella.
   d. Provide complete with pedestal anchor, rear anchors and escutcheons.

E. Safety Line shall be 3/4" diameter polypropylene rope with 5"x9" polyethylene floats on 5 feet center. Lines shall be fitted with chrome plated bronze hooks at each end. Lines shall be No. C2983 by KDI Paragon or approved equal.

F. Handicap Lift:

   1. Battery Operated Lift, equivalent to Lincoln Splash Aquatic Lift, Model Number 81-220.
   2. Provide required deck anchor with grounding lug.

G. Stanchion Posts: Deck sockets and anchors, with grounding lugs provided by Contractor. Stanchions and flags/ropes, By Owner.

   1. Non corrodible anchors with grounding lugs.

H. Starting Platforms (6 required per Pool, Anchors provided by Contractor, Stands provided by Owner):

   1. Cantilever type, Equal to KDI Paragon "Standard" Model #23213 Quickset. Frames of T304 stainless steel tubing 1.9" O.D. by .109" thickness. Platform of 12 gauge T304 stainless steel or PVC bar type grating with "non slip" surface.

   2. Mounting step of 12 gauge T304 stainless steel with "non slip" surface.
   3. Backstroke bar of 1" Schedule 40 stainless steel pipe welded to frame.
   4. All welds by inert gas process. Welds, corners and sharp edges to be ground smooth and polished to match adjacent surfaces.
   5. Non corrodible anchors designed for quick and easy mounting and removal of platforms without the use of tools.
   6. Provide grounding lugs on anchors.

I. Portable Vacuum (1 Required) Electric, portable unit.

   1. Filter: Provide stainless steel filter canister, designed to receive cartridge filter with a minimum 155 square feet of surface area. Canister shall have removable top. Provide a spare cartridge filter, two total.

2. Pump: 1 ½ horsepower pump, pre-plumbed to the filter canister and mechanically fastened to the cart. Pump shall be pre-wired with a 100-foot electrical cord, GFCI shock protector and 110 volt AC switch.
3. Plumbing: Provide 2" shut-off valves and quick connect hose fittings.
4. Cart: Portable cart shall be constructed of stainless steel, with components having a minimum wall thickness of 0.065". All metallic components shall be passivated. Finish surfaces shall be polished to a number 6 finish. The cart shall have two, 13-inch pneumatic wheels.
5. Accessories:
   a. Vacuum Head: Provide minimum 19" wide, flexible vacuum head, with swivel wheels and lead weights.
   b. Pole: Provide minimum 24-foot telescoping aluminum pole.
   c. Hose: Provide 2" x 75-foot, heavy-duty, flexible floating hose. Hose to be crushproof and leakproof. Provide all necessary fittings for quick-connect use.
   d. Hose Reel: Provide stainless steel, wheeled hose reel, equivalent to KDI. Reel to be appropriately sized for specified hose.

J. Wall Brush (1 required) shall be 24" in width with 5 rows of nylon or comparable synthetic bristles set in a synthetic brush back and attached to an anodized aluminum handle bracket. Brush shall be furnished complete with a 1-1/4" O.D. anodized aluminum pole 16' in length. Wall brush shall be equivalent to Recreonics 10-155.

K. Water Test Kit (1 Required – By Owner): Equivalent to Taylor Model 1765, Chlorine and pH Slide Comparator Test Kit.

2.18 Pool Safety Equipment

A. The following items of safety equipment shall be furnished and installed in the project. All anchor sockets shall be of stainless steel with flush mounted escutcheon plates. All anchorage shall be set in place by the Contractor. All anchorage shall be bonded in accordance with Article 680, National Electric Code. All accessories necessary for the proper installation and performance of the equipment specified shall be supplied whether completely specified or not.

1. Life Preserver and Line: (9 Required) shall be a 24" O.D. vinyl clad PVC foam ring buoy with a throwing line of 1/2" polyethylene rope attached at four points. Preserver shall be U.S.C.G. approved and as manufactured by Swimquip, Catalog No. 9473, or approved equal. Throw lines shall be 120 feet long.
2. Life Hook: (9 Required) shall consist of a heavy duty aluminum double "Shepherds Crook" with a 16' aluminum pole. Crook and pole shall be Model 12-237 by Recreonics.
3. Rescue Tubes: (9 Required) shall be 42" Adolph Kiefer Red Cross Model #620042.
4. Spine Board: (2 Required) Adolph Kiefer Red Cross spine board with Head Immobilizer and 3 Restraint Straps #600541.
5. First Aid Kit: (9 Required) Recreonics #12-013 24 Unit First Aid Kit.
6. Cot: (1 Required per Pool bathhouse) Provide collapsible aluminum frame stretcher with restraints.
7. Blankets: (1 Required per Pool Bathhouse) Provide 72" long warming blankets. Blankets to be 70% wool blend, fire retardant.

PART III EXECUTION

3.01 Inspection and Verification

A. Verify that all equipment and components related to the required work and necessary for a complete operational pool system is provided.

B. Certain dimensional tolerances for the pool are critical: length, depths, diving section profile, and clearances for diving stand. Verify these dimensions and notify Construction manager of discrepancies from specified standards.

C. Notify Construction Manager of defects requiring correction. Do not start work until approved by Architect and directed by Construction Manager.

3.02 Coordination of Work

A. Coordinate with the Construction Manager and sub-contractors for related work to assure orderly progress and timely completion of the project.

B. Provide written instructions, drawings, diagrams, templates or on-site supervision as required to assure proper installation of equipment and accessories as provided "furnished only" under this section.

3.03 Product Delivery, Storage and Handling

A. Deliver shop fabricated equipment and components to job site crated and packaged to prevent damage.

B. Unload and store in designated area as directed by Construction Manager.

3.04 Perimeter System

A. To insure singular responsibility for product quality, performance and guaranty, the systems shall be installed by the manufacturer.

B. Install perimeter systems to specified dimensional tolerances and level to plus or minus 1/8"in 100'. All welding to be performed by experienced installers and according to standards of the American Welding Society.

C. Instruct concrete contractor as to proper mix and placement procedure to assure grouting operation does not misalign gutter system.

3.05 Filtration and Treatment Equipment

A. Supervise installation and start-up according to approved shop drawings. Assure adequate clearances for access, inspection, maintenance and safe operation.

B. Provide flanged connections, “spool pieces” and quick disconnects as required for easy removal and replacement of major components. All transitions between pipes of different sizes shall be made by use of concentric or eccentric fittings.

3.06 Start-up and Balancing

A. Consult with Owner to assist with chemical testing of pool water supply and advise Owner on initial chemical treatment required for proper chemical balancing.

B. Start pool recirculation systems, adjust for proper operation, and instruct Owner’s designated representative in proper operation and maintenance of pools and pool systems. Remain with operator until pools are ready for use in accordance with requirements of state pool regulations.

C. Provide three (3) bound sets of manufacturers’ printed operating and maintenance instructions, product data, and guarantees for equipment and systems furnished hereunder.

D. Provide one follow-up visit within 30 days of initial start-up, or as agreed with Owner, to inspect the operation of the pools and pool systems, provide corrective instructions if necessary, and submit a written report to the Owner.

END OF SECTION 131500

SECTION 220100 - PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents as listed on the Table of Contents and including General and Supplementary Conditions and Division 1 - General Requirements shall be included in and made part of this Section.

1.2 DESCRIPTION OF WORK

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

C. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation, of all systems as indicated on the drawings and specified herein.

D. The specifications and drawings describe the minimum requirements that must be met by the Plumbing Subcontractor for the installation of all work as shown on the drawings and as specified herein under.

E. Coordinate work with that of all other Trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

1.3 INTENT

A. It is the intent of the Contract Documents to require finished work, tested and ready for operation.

B. It is not intended that Contract Documents show every pipe, fitting and appurtenance; however, such parts as may be necessary to complete the systems in accordance with best trade practice and Code requirements and to Architect’s satisfaction shall be deemed to be included.

C. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. DO NOT SCALE THE DRAWINGS.

1.4 DEFINITIONS

A. Words in the singular shall also mean and include the plural, wherever the context so indicates, and words in the plural shall mean the singular, wherever the context so indicates.

B. “Acceptable”: Acceptable, as determined in the opinion of the Architect.

C. The term “Acceptable equivalent” or “Equal”: Of weight, size, design, capacity and efficiency to meet requirements specified and shown, and of acceptable manufacturer, as determined in the opinion of the Architect.

D. "Accessible": Indicates ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, etc. to gain access. "Accessible ceiling" indicates acoustic tile type hung ceilings. Concealed spline or sheetrock ceilings with access panels shall not be considered accessible ceilings.

E. "Approved", or "Approval": Shall mean the written approval of the Architect

F. "Architect": Shall refer to the Architect: “TLB Architecture, LLC” and/or the Engineer "Innovative Engineering Services, LLC.”

G. “Concealed”: Hidden from site, embedded in masonry or other construction; or installed in furred spaces, trenches or crawl spaces; or installed within double partitions or hung ceilings; or in enclosures.

H. The term "Contract Documents": Shall mean the entire set of Drawings and Specifications as listed in the Table of Contents of the General Conditions including all bound and unbound material and all items officially issued to date such as addenda, bulletins, job modifications, etc.

I. “Contractor”: General Contractor.

J. The term "Directed", "Required", "Permitted", "Ordered", "Designated", "Prescribed", and similar words: Shall mean the direction, requirement, permission, order, designation or prescription of the Architect; the terms "Approved", "Acceptable", "Satisfactory", and similar words shall mean approved by, acceptable or satisfactory to the Architect; and, the terms "Necessary", "Reasonable", "Proper", "Correct", and similar words shall mean necessary, reasonable, proper or correct in the judgment of the Architect.

K. “Exposed”: Visible to building occupants, excluding mechanical room and utility tunnel locations.

L. The term “Furnish” or “Supply”: Shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

M. The term “Finished”: Refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

N. The term “Indicated”: Refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract

Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

O. “Installed”: Shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

P. "Material": Is used in the specifications it will mean any "Product", "Equipment", "Device", "Assembly", or "Item" required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.

Q. “Named” Product: Manufacturer’s name for product, as recorded in published documents of latest issue as of date of Contract Documents. Obtain Architect’s permission before using products of later or earlier model.

R. "Owner": Shall refer to the Owner: “Town of New Britain” or designated representative.

S. "Other Work Contractor" (O.W.C.): Refers to the Contractor(s), or Subcontractor(s) performing work under other Sections of the Contract Documents.

T. "Plumbing Subcontractor": Refers to the Subcontractor responsible for furnishing and installation of all work indicated on the Plumbing drawings and in the Plumbing specifications.

U. “Product”: Shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

V. "Provide": Is used in the specifications it will mean "Furnish" and "Install", "Connect", "Apply", Erect", "Construct", or similar terms, unless otherwise indicated in the specifications.

W. The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work

X. The term “Remove” means to disconnect from its present position, remove from the premises and to dispose of in a legal manner.

Y. The term "Shown on Drawings": Is used in the specifications, they shall mean "Noted", "Indicated", "Scheduled", "Detailed", or any other diagrammatic or written reference made on the drawings

Z. The term “Special Warranties” Are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

AA. "Specification": Shall mean all information contained in the bound or unbound volume, including all "Contract Documents" defined therein, except for the drawings.

BB. The term “Standard Product Warranties” Are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

CC. "Substitution": Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "Substitutions".

DD. "Wiring": Shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

EE. "Work": Labor, materials, equipment, apparatus, controls and accessories required for proper and complete installation.

1.5 RELATED WORK

A. For work to be included as part of this Section, to be furnished and installed by the Plumbing Subcontractor, refer to the following Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220517	Sleeves and Sleeve Seals for Plumbing Piping
3.	Section 220518	Escutcheons for Plumbing Piping
4.	Section 220519	Meters and Gauges for Plumbing Piping
5.	Section 220523	General Duty Valves for Plumbing Piping
6.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
7.	Section 220553	Identification for Plumbing Piping and Equipment
8.	Section 220719	Plumbing Piping Insulation
9.	Section 221116	Domestic Water Piping
10.	Section 221119	Domestic Water Piping Specialties
11.	Section 221123	Natural Gas Piping
12.	Section 221316	Sanitary Waste and Vent Piping
13.	Section 221319	Sanitary Waste Pipe Specialties
14.	Section 221413	Storm Drainage Piping
15.	Section 221423	Storm Drainage Piping Specialties
16.	Section 223300	Electric Domestic Water Heaters
17.	Section 223400	Fuel Fired Domestic Water Heaters
18.	Section 224300	Plumbing Fixtures

B. For work related to, and to be coordinated with the Plumbing work, but not included in this Section and required to be performed under other designated Sections, see the following:

1. Division 4 Section "Masonry Work" for Plumbing construction.
2. Division 7 Section "Fire stopping".
3. Division 7 Section "Caulking, Flashing, Waterproofing, Roofing and setting of Roof Drains".
4. Division 8 Section "Access Panels".
5. Division 9 Section "Painting".
6. Division 33 Site Work.

1.6 DRAWINGS

A. The Contract Drawings are diagrammatic only intending to show general runs and locations of the ductwork, piping, equipment, systems equipment, etc. and not necessarily showing all required offsets, details and accessories and equipment to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation which will afford maximum accessibility for operation, maintenance and headroom.

B. Where discrepancies in scope of work as to what Trade provides items, such conflicts shall be reported to the Architect during bidding and prior to signing of the Contract. If such action is not taken, the Plumbing Subcontractor shall furnish such items as part of his work as necessary, for complete and operable systems and equipment, as determined by the Architect.

C. The Plumbing Subcontractor shall coordinate the installation of all equipment.

D. Where drawing details, plans, specification requirements and/or scheduled equipment capacities are in conflict or equipment are shown to be different between plans and/or between plans and riser diagrams, details or specifications, the most stringent requirement will be included in the Contract. Plumbing systems and equipment called for in the specification and/or shown on the drawings shall be provided under this Contract as if it were required by both the drawings and specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.

1.7 CODES AND STANDARDS

A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards and Utility Company Regulations, latest editions.

B. In case of difference between Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations and the Contract Documents, the Plumbing Subcontractor shall promptly notify the Architect in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the Plumbing Subcontractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect/Owner.

E. Applicable Codes and Standards shall include all State Laws, Local Ordinances, Utility Company Regulations, and the applicable requirements of the latest adopted edition of the following Codes and Standards, without limiting the number, as follows:

1. NFPA 70: National Electrical Code
2. NFPA 101: Life Safety Code
3. Occupational Safety and Health Standards
4. Environmental Protection Agency
5. National Plumbing Association
6. Department of Environmental Protection
7. Uniform Building Code (UBC)
8. International Building Code (IBC), 2003, as amended by the 2005 Connecticut Supplement and 2009 Addendum.
9. International Energy Conservation Code, 2006.
10. State Demolition Code.
11. State Fire Safety Code.
12. Local Building Code.

13. ICC/ANSI A117.1, 2003, Accessible and Usable Buildings and Facilities.

F. In these specifications, references made to the following Industry Standards and Code Bodies are intended to indicate the latest volume or publication of the Standard. All equipment, materials and details of installation shall comply with the requirements and latest revisions of the following Bodies, as applicable:

ANSI:	American National Standards Institute
ASTM/ASME:	American Society of Testing Materials
ASSE:	American Society of Sanitary Engineers
AWS:	American Welding Society
AWWA:	American Water Works Association
NEMA:	National Electrical Manufacturers Association
NFPA:	National Fire Protection Association
UL:	Underwriters' Laboratories
NBS:	National Bureau of Standards
NSC:	National Safety Council

G. Plumbing Subcontractor for the work in his scope of work shall give all necessary notices, obtain all permits, pay all governmental taxes, fees and other costs in connection with his work; file for necessary approvals with the jurisdiction under which the work is to be performed. Plumbing Subcontractor shall obtain all required Certificates of Inspection for his respective work and deliver same to the Architect before request for acceptance of his portion of work is made and before final payment.

1.8 PERMITS AND FEES

A. Plumbing Subcontractor for the work in his scope of work shall give all necessary notices, obtain all permits, pay all governmental taxes, fees and other costs in connection with his work; file for necessary approvals with the jurisdiction under which the work is to be performed. Plumbing Subcontractor shall obtain all required Certificates of Inspection for his respective work and deliver same to the Architect before request for acceptance of his portion of work is made and before final payment.

1.9 QUALITY ASSURANCE

A. The manufacturers listed within these specifications have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified.

B. Plumbing Subcontractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner.

C. Where equipment of a substitute manufacturer differ from that specified and require different arrangement or connections from those shown, it shall be the responsibility of the Subcontractor responsible for the substitution to modify the installation of the equipment/system to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Plumbing Subcontractor shall submit drawings showing the proposed, substitute installation. If the proposed installation is accepted, the Plumbing Subcontractor shall make all necessary changes in all affected related work provided under his

and other Sections including location of roughing-in connections by other Trades, supports, etc. All changes shall be made at no increase in the Contract amount or additional cost to the Owner. The General Contractor shall be responsible to assure that the Subcontractor responsible for the substitution bears the cost arising to all other Trades as a result of the substitution.

D. Unless specifically indicated otherwise, all equipment and materials required for installation under these specifications shall be new, unused and without blemish or defect. Equipment and materials shall be products which will meet with the acceptance of the Authorities having jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed and/or labeled by FM or UL or another testing laboratory, the products shall be so listed and/or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.

1.10 SUBSTITUTIONS

A. Contractor shall pay Architect/Engineer for time spent reviewing substitution requests. Charges shall be $120/hour. Submittal of substitution request will be construed as evidence of Contractor's agreement to pay such charges, with no added cost to Owner.

B. Contractor's request for substitution may be submitted only after award of Contract. Requests shall be in writing on Contractor's letterhead and shall include:

1. Contractor's detailed comparison of significant qualities between specified item and proposed substitution.
2. Statement of effect on construction time, coordination with other affected work, and cost information or proposal.
3. Contractor's statement to the effect that proposed substitution will result in overall work equal to, or better than, work originally intended.

C. Substitution requests will be considered: If extensive revisions to Contract Documents are not required; if changes are in keeping with general intent of Contract Documents; if submitted in timely and proper manner, fully documented; and if one or more of following conditions is satisfied; all as judged by Architect:

1. Where request is directly related to "acceptable equivalent" clause, "or equal" clause or words of similar effect in Contract Documents.
2. Where specified product, material or method cannot be provided within Contract Time; but not as a result of Contractor's failure to pursue the work promptly or to coordinate various activities properly.
3. Where specified product, material or method cannot be provided in manner which is compatible with other materials of the work and where Contractor certifies that proposed substitution is compatible.
4. Where specified product, material or method cannot be properly coordinated with other materials of the work and where Contractor certifies that proposed substitution can be properly coordinated.
5. Where specified product, material or method cannot be warranted as required and where Contractor certifies that proposed substitution can be so warranted.
6. Where specified product, material or method cannot be used without adversely affecting Owner's insurance coverage on completed work and where Contractor certifies that proposed substitution can be so used.

7. Where specified product, material or method will encounter other substantial non-compliance, which are not possible to otherwise overcome except by using proposed substitution.
8. Where specified product, material or method cannot receive required approval by governing authority and proposed substitution can be so approved.
9. Where substantial advantage is offered to the Owner; in terms of cost, time, energy conservation or other valuable considerations; after deducting offsetting responsibilities that Owner may be required to bear, including additional compensation to Architect for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.

D. The burden is upon the Contractor, supplier and manufacturer to satisfy Architect that:

1. Proposed substitute is equal to, or superior to, the item specified.
2. Intent of the Contract Documents, including required performance, capacity, efficiency, quality, durability, safety, function, appearance, space clearances and delivery date, will be equaled or bettered.

E. Submission of shop drawings of unspecified manufacturer or shop drawings at variance with the Contract Documents is not a proper request for substitution.

F. Changes in work of other trades, such as structural supports, which are required as a result of substitution and the associated costs for such changes shall be the complete responsibility of Contractor proposing substitution and there shall be no additional expense to the Owner.

1.11 SUBMITTALS

A. Prepare and submit shop drawings in accordance with the requirements hereinbefore specified, and with Division 1 Section “Submittal Procedures” in the manner described therein, modified as noted hereinafter.

B. The selection and intention to use a product specified by name shall not excuse the need for timely submission of shop drawings for that product.

C. Prior to submitting shop drawings, submit for review preliminary list of intended or proposed manufacturers for all items for which shop drawings are required.

D. Submission of shop drawings of an unnamed manufacture or shop drawings at variance with the Contract Documents is not a proper request for substitution.

E. Samples that are submitted in lieu of shop drawings shall be clearly identified and shall be submitted in duplicate. Only one sample will be returned and that accepted sample shall be kept available at appropriate job site office. Accepted sample retained by Architect will be kept available at Architect’s home office.

F. Upon completion of shop drawing review, shop drawings will be returned, marked with one of following notations: No Exception Taken, Revise as Noted, Revise and Resubmit, or Rejected. Only products whose shop drawings are marked “No Exception Taken” or “Revise as Noted” shall be used on the project.

G. Submittals shall include the following information:

1. Descriptive and product data necessary to verify compliance with Contract Documents.
2. Manufacturer's specifications including materials of construction, metal gauge, thickness and finish.
3. Certified dimensional drawings including clearances required for maintenance or access.
4. Performance data, ratings, operating characteristics, and operating limits.
5. Electrical ratings and characteristics.
6. Wiring and control diagrams, where applicable.
7. Certifications requested, including UL label or listing.
8. List of accessories, which are required but are not being provided by the product manufacturer or are not being furnished under this Section. Identify the Section(s) under which the accessories are being furnished.

H. In addition, submittals shall be clearly marked for the following:

1. Specification Section and Paragraph, or Drawing Schedule/Note/Detail/etc., where equipment is specified.
2. Equipment or fixture identification corresponding to that used in Contract Documents.
3. Accessories and special or non-standard features and materials which are being furnished.

1.12 PRODUCT SELECTION

A. Contractor's options for selecting products are limited by Contract Document requirements and governing regulations and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are not necessarily limited to, following various methods of specifying:

1. Single Product Manufacturer Named: Provide product indicated. Advise Architect, and obtain instructions before proceeding, when named product is known to be unacceptable or not feasible.
2. Two or More Manufacturers' Products Named: Provide one of the named products, at Contractor's option, but excluding products which do not comply with requirements. Do not provide, nor offer to provide, an unnamed product unless named products do not comply with requirements or are not feasible.
3. "Acceptable Equivalent" or "Or Equal": Where named products are accompanied by this term or words of similar effect, provide named products or propose substitute product according to paragraph 1.10, SUBSTITUTIONS.
4. Standards, Codes and Regulations: Where specification requires only compliance with a standard, code or regulation, Contractor may select any product which complies with requirements of that standard, code or regulation.
5. Performance Requirements: Provide products which comply with specific performances indicated and which are recommended by manufacturer (in published product literature or by individual certification) for application intended. Overall performance of product is implied where product is specified with only certain specific performance requirements.
6. Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements using specified materials and

components, and complying with specified requirements for fabricating, finishing, testing and other manufacturing processes.

7. Visual Matching: Where matching with an established material is required, Architect's judgment of whether proposed product matches established material shall be final. Where product specified does NOT match established material, propose substitute product according to paragraph 1.10, SUBSTITUTIONS. Follow requirements for CHANGE ORDERS, also, if matching product within cost category of specified product is not available.
8. "Color as Selected by Architect": Unless otherwise noted, where specified product requirements include "Color as Selected by Architect" or words of similar effect, the selection of manufacturer and basic product complying with Contract Documents is Contractor's option and subsequent selection of color is Architect's option.

B. Inclusion by name, of more than one manufacturer or fabricator, does not necessarily imply acceptability of standard products of those named. All manufacturers, named or proposed, shall conform, with modification as necessary, to criteria established by contract documents for performance, efficiency, materials and special accessories.

1.13 COORDINATION DRAWINGS

A. Before materials are purchased, fabricated or work is begun, each Subcontractor shall prepare and obtain approval of coordination drawings, and sections for all floors/areas, including buried system/services, resulting in one (1) set of all-Trade-composite at 3/8" scale drawings, showing the size and location of all equipment, in the manner described herein under General Requirements. Architects review and approval of coordination drawings must be obtained prior to any fabrication or installation of any equipment or systems.

B. The coordination drawings shall be generated from a computer CAD program compatible with AutoCAD Release 2013, in DWG or DXF format. The Plumbing Subcontractor shall take the lead, supervise, and coordinate production of coordinated layout drawings, to show and coordinate all equipment. These drawings shall then be circulated to the Plumbing Subcontractor so that he can indicate all his work as directed by the General Contractor and Architect and as required, to result in a fully coordinated installation.

C. All costs associated with all aspects of coordination drawings, regardless as to how long they take to produce and how many times they have to be redrawn, shall be borne by the Plumbing Subcontractor.

D. The Plumbing Subcontractor may purchase the Plumbing AutoCAD computer drawing files from the Plumbing Contract set on disk or via modem from the Engineer at the nominal cost of $250.00, if he so chooses.

1.14 COORDINATION OF WORK WITH OTHER TRADES

A. The Plumbing Subcontractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the Plumbing work.

B. Coordinate work with that of all other Trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

C. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Plumbing Subcontractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of the Plumbing Subcontractor or that of any other trade caused by the Plumbing Subcontractor's neglect, shall be made by him at his own expense, to the Architect's satisfaction.

D. The Plumbing Subcontractor must include in his bid sufficient dollar amounts to coordinate the work of this Contract. This project is complex and will require additional time to coordinate all Trades and allow implementation of the Owners Standards and maintenance serviceability requirements. This requirement shall include, but not be limited to, producing the coordination drawings, as many times and as many drawings as required, to ensure serviceability of equipment, as approved by the Architect.

E. Locations of ductwork and piping distribution, equipment, systems, etc. shall be adjusted to accommodate the work with interferences anticipated and encountered. The Plumbing Subcontractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system component. Accurate measurements and coordination drawings shall be completed to verify dimensions and characteristics of the various systems installations.

F. Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam piping shall normally have the right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.

G. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. The Plumbing Subcontractor shall provide elbows, fittings, offsets in ductwork and piping, etc. as required for his work to affect these offsets, transitions and changes in direction.

H. All work shall be installed in a way to permit removal (without damage to other parts) all other system components provided under this Contract requiring periodic replacement or maintenance. All work shall be done to allow easy access for maintaining equipment. The Owner and Engineer will require proof via the preparation of large scale sections and part plans that pull and junction boxes, etc. are accessible after the work is completed. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect.

I. Any equipment shown on the Plumbing and/or Architectural drawings to be provided with services shall be included under this Contract as applicable to make equipment complete and operable. Additional equipment, etc., shall be provided to accomplish the above requirement, as required, all as part of this Contract, at no extra cost to the Owner. This requirement necessitates that the Plumbing Subcontractor review the Architectural drawings and the drawings of other Trades during bidding to ascertain the extent of all requirements, and interface between the Trades and scope of work.

J. The Plumbing Subcontractor shall coordinate his work with other Trades' work so that all equipment and systems can be easily, safety and properly serviced and maintained. It is imperative that service personnel can safely access all equipment. Provide safety rails, steps, ladders, valve chains, handle extensions, etc. as required, in addition to the ones shown on the

drawings, to ensure safe and easy access to all equipment is provided in a manner approved by the Architect.

1.15 WARRANTEE

A. Attention is directed to provisions of the General Requirements and Supplementary General Requirements regarding and warranties for work under this Contract.

B. All warranties shall begin on the Date of Substantial Completion of the entire project or the Owner's acceptance of the workmanship and/or material covered by the warranty, whichever is later. The warranty coverage shall continue for the specified period. Refer to individual specification sections for warranty period. If no specific warranty period is specified, the warranty shall extend for a minimum of 365 days.

C. Manufacturers shall provide their standard warranties for work under the Plumbing Trades. However, such warranties shall be in addition to, and not in lieu of, all other liabilities which the manufacturer and Plumbing Subcontractor may have by law or by other provisions of the Contract Documents.

D. All materials, items of equipment and workmanship furnished under the Plumbing Section shall carry the standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Plumbing Subcontractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.

E. The Plumbing Subcontractor shall warranty that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

F. Upon receipt of notice from the Owner or Architect of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by the Plumbing Subcontractor for his work or any other work affected by the failure(s).

G. Plumbing Subcontractor shall furnish, before the final payment is made, a written warranty covering the above requirements in accordance with the General Requirements.

1.16 THE SUBCONTRACTOR

A. The Plumbing Subcontractor shall visit the site of the proposed new facility and base his bids from his own site examinations and estimates. The Plumbing Subcontractor shall not hold the Architect, Engineer, Owner or their agents or employees responsible for, or bound by, any schedule, estimate or of any plan thereof. The Plumbing Subcontractor shall study the Contract Documents included under this Contract to determine exactly the extent of work provided under this Contract, as well as to ascertain the difficulty to be encountered in performing the work, in installing new equipment and systems and coordinating the work with the other Trades and existing building conditions.

B. The Plumbing Subcontractor shall faithfully execute his work according to the terms and conditions of the Contract and specifications, and shall take all responsibility for and bear all losses resulting to him in the execution of his work.

C. The Plumbing Subcontractor shall be responsible for the location and performance of work provided under his Contract as indicated on the Contract Documents. All parties employed directly or indirectly by the Plumbing Subcontractor shall perform their work according to all the conditions as set forth in these specifications.

D. The Plumbing Subcontractor shall furnish all materials and do all work in accordance with these specifications, and any supplementary documents provided by the Architect. The work shall include everything shown on the drawings and/or required by the specifications as interpreted by the Architect, regardless of where such information is indicated in the Contract Documents (Architectural, Electrical, Fire Protection, HVAC, etc.). Unless specifically indicated otherwise, all work and materials furnished and installed shall be new, unused and of the best quality and workmanship. The Plumbing Subcontractor shall cooperate with the Architect so that no error or discrepancy in the Contract Documents shall cause defective materials to be used or poor workmanship to be performed.

1.17 COORDINATION OF WORK

A. The Plumbing Subcontractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the Plumbing work.

B. Coordinate work with that of all other Trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

C. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Plumbing Subcontractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of the Plumbing Subcontractor or that of any other trade caused by the Plumbing Subcontractor's neglect, shall be made by him at his own expense, to the Architect's satisfaction.

D. The Plumbing Subcontractor must include in his bid sufficient dollar amounts to coordinate the work of this Contract. This project is complex and will require additional time to coordinate all Trades and allow implementation of the Owners Standards and maintenance serviceability requirements. This requirement shall include, but not be limited to, producing the coordination drawings, as many times and as many drawings as required, to ensure serviceability of equipment, as approved by the Architect.

E. Locations of ductwork and piping distribution, equipment, systems, etc. shall be adjusted to accommodate the work with interferences anticipated and encountered. The Plumbing Subcontractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system component. Accurate measurements and coordination drawings shall be completed to verify dimensions and characteristics of the various systems installations.

F. Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam piping shall normally have the right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.

G. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. The

Plumbing Subcontractor shall provide elbows, fittings, offsets in ductwork and piping, etc. as required for his work to affect these offsets, transitions and changes in direction.

H. All work shall be installed in a way to permit removal (without damage to other parts) all other system components provided under this Contract requiring periodic replacement or maintenance. All work shall be done to allow easy access for maintaining equipment. The Owner and Engineer will require proof via the preparation of large scale sections and part plans that pull and junction boxes, etc. are accessible after the work is completed. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect.

I. The Contract Drawings are diagrammatic only intending to show general runs and locations of the ductwork, piping, equipment, systems equipment, etc. and not necessarily showing all required offsets, details and accessories and equipment to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation which will afford maximum accessibility for operation, maintenance and headroom.

J. Where discrepancies in scope of work as to what Trade provides items, such conflicts shall be reported to the Architect during bidding and prior to signing of the Contract. If such action is not taken, the Plumbing Subcontractor shall furnish such items as part of his work as necessary, for complete and operable systems and equipment, as determined by the Architect.

K. The Plumbing Subcontractor shall coordinate the installation of all equipment.

L. Where drawing details, plans, specification requirements and/or scheduled equipment capacities are in conflict or equipment are shown to be different between plans and/or between plans and riser diagrams, details or specifications, the most stringent requirement will be included in the Contract. Plumbing systems and equipment called for in the specification and/or shown on the drawings shall be provided under this Contract as if it were required by both the drawings and specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.

M. Any equipment shown on the Plumbing and/or Architectural drawings to be provided with services shall be included under this Contract as applicable to make equipment complete and operable. Additional equipment, etc., shall be provided to accomplish the above requirement, as required, all as part of this Contract, at no extra cost to the Owner. This requirement necessitates that the Plumbing Subcontractor review the Architectural drawings and the drawings of other Trades during bidding to ascertain the extent of all requirements, and interface between the Trades and scope of work.

N. The Plumbing Subcontractor shall coordinate his work with other Trades' work so that all equipment and systems can be easily, safety and properly serviced and maintained. It is imperative that service personnel can safely access all equipment. Provide safety rails, steps, ladders, valve chains, handle extensions, etc. as required, in addition to the ones shown on the drawings, to ensure safe and easy access to all equipment is provided in a manner approved by the Architect.

1.18 GIVING INFORMATION

A. Plumbing Subcontractor shall keep himself fully informed as to the shape, size and position of all openings required for his apparatus and shall give information to the General Contractor and other Subcontractors sufficiently in advance of the work so that all openings may be built in advance.

1.19 EQUIPMENT AND MATERIALS

A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, but readily accessible for inspection by the Architect until installed. All items subject to moisture damage such as controls shall be stored in dry, heated spaces.

B. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned and polished thoroughly and turned over to the Owner in a condition satisfactory to the Architect. Damage or defects that develop before acceptance of the work shall be made good at the Plumbing Subcontractor's expense.

C. The Plumbing Subcontractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.

D. Manufacturer's directions shall be followed completely in the delivery, storage, protection and installation. Promptly notify the Architect in writing of any conflict between any requirements of the Contract Documents and the manufacturer's directions. Obtain the Architect's written instructions before proceeding with the work. Should Plumbing Subcontractor perform any work that does not comply with the manufacturer's directions or written instructions from the Architect, he shall bear all costs arising in correcting any deficiencies that should arise.

E. All equipment of one type shall be the products of one manufacturer.

F. Equipment prepurchased by the General Contractor on behalf of the Owner or by the Owner himself, if assigned to the Plumbing Subcontractor, shall be received, installed, tested, etc., as if the equipment was purchased by the Plumbing Subcontractor. All guarantees, service contracts, etc., shall be the same as for all other equipment provided under this Contract.

1.20 USE OF PREMISES

A. The Plumbing Subcontractor shall confine all apparatus, storage of materials and construction to the limits as directed by the Architect and he shall not encumber the premises with his materials. The Plumbing Subcontractor shall be held responsible for repairs, patching, or cleaning arising from any unauthorized use of premises.

B. Notwithstanding any approvals or instructions which must be obtained by the Plumbing Subcontractor from the Architect in connection with the use of the premises, the responsibility for the safe working conditions at the site shall remain that of the Plumbing Subcontractor. The Architect, Engineer or Owner shall not be deemed to have any responsibility or liability in connection with safe working conditions at the site.

1.21 PROTECTION

A. Materials, equipment, etc., shall be properly protected during construction and all conduit openings shall be temporarily closed so as to prevent obstruction and damage. Post notice prohibiting the use of all systems provided under the Plumbing Contract, prior to completion of work and acceptance of all systems by the Owner except as otherwise, instructed by Architect. Take precautions to protect all materials furnished from damage and theft.

B. The Plumbing Subcontractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or Plumbing systems provided under his Contract.

1.22 DAMAGE TO OTHER WORK

A. The Plumbing Subcontractor shall be held responsible and shall pay for all damages caused by his work to the building structures, equipment, systems, etc., and all work and finishes installed under this Contract. Repair of such damage shall be done by the General Contractor at the expense of the Plumbing Subcontractor, to the Architect's satisfaction.

1.23 CORRECTION OF WORK

A. The Plumbing Subcontractor shall promptly correct all work provided under his Contract and rejected by the Architect as defective or as failing to conform to the Contract Documents, whether observed before or after completion of work, and whether or not fabricated, installed or completed.

1.24 EXTRA WORK

A. No claim for extra work will be allowed unless it is authorized by the Architect before commencement of the extra said work.

1.25 TOUCH-UP PAINTING

A. All equipment and systems shall be thoroughly cleaned of rust, splatters and other foreign matter of discoloration leaving every part of all systems in an acceptable prime condition. The Plumbing Subcontractor for the work under his Contract shall refinish and restore to the original condition all equipment which has sustained damage to the manufacturer's prime and finish coats of paint and/or enamel during the course of construction, regardless of the source of damage.

1.26 PARTS LIST AND INSTRUCTIONS FOR OPERATION AND MAINTENANCE

A. The Plumbing Subcontractor shall thoroughly instruct the Owner, to the complete satisfaction of the Architect, in the proper operation of all systems and equipment provided by him. The Plumbing Subcontractor shall make arrangements, via the Architect, as to whom the instructions are to be given in the operation of the basic and auxiliary systems and the period of time in which they are to be given. The Architect shall be completely satisfied that the Owner has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Plumbing Subcontractor to the Owner's representative, then the Plumbing Subcontractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this specification has been complied with.

B. Plumbing Subcontractor shall submit to the Architect for approval, the required typed sets (see General Conditions and Division 1) bound neatly in loose-leaf binders, of all instructions for the installation, operation, emergency operation, start-up, care and maintenance of all equipment and systems (including instructions for the ordering and stocking of spare parts for all equipment installed under this Contract). The lists shall include part numbers and suggested supplier. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.

C. Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub-index for each section shall also be provided. The methodology of setting-up the manuals shall be submitted to the Architect and Owner for review prior to final submission of manuals.

1.27 MANUFACTURER'S REPRESENTATIVE

A. The Plumbing Subcontractor shall provide, at the appropriate time or as directed by Architect, the on-site services of a competent factory trained Engineer of the manufacturer of specific equipment, to inspect, test, adjust and place in proper operating condition any and all items of the same manufacturer. No additional compensation will be allowed for such services. A written report shall be issued by the particular manufacturer with his findings for the Architect's record.

1.28 RECORD DRAWINGS/AS-BUILT DRAWINGS

A. The Plumbing Subcontractor shall maintain current at the site a set of his drawings on which he shall accurately show the actual installation of all work provided under his Contract indicating hereon any variation from the Contract Drawings, in accordance with the General Conditions and Division 1. Changes, whether resulting from formal change orders or other instructions issued by the Architect, shall be recorded. Include changes in sizes, location, and dimensions of equipment, etc.

B. The Plumbing Subcontractor shall indicate progress by coloring-in equipment and associated appurtenances exactly as they are erected. This process shall incorporate both the changes noted above and all other deviations from the original drawings whether resulting from job conditions encountered or from any other causes.

C. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed. They shall be inspected periodically by the Architect and Owner and they shall be corrected immediately if found either inaccurate or incomplete. This procedure is mandatory.

D. At the completion of the job, these prints shall be submitted to the General Contractor and then to the Architect for final review and comment. The prints will be returned with appropriate comments and recommendations. These corrected prints, together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of As-built Record Drawings.

E. The Subcontractor shall be responsible for generating as-built Record Drawings utilizing CAD based documents in AutoCAD Release 2000 DWG or DXF format. A bound set of plans, as well as the computer files, on disk, shall be turned over to the Architect for review. After acceptance of the as-built documents by the Architect, the Plumbing Subcontractor shall make any corrections necessary to the as-built documents and prepare one reproducible set of

drawings as well as bound blueprint set(s) (quantity as determined by the Architect) for distribution to the Owner via the Architect.

F. The Plumbing Subcontractor may use the computer drawing files used for coordination drawings or purchase the Engineers most recently updated computer drawing files at a nominal charge of $500.00 per drawing file. The updated drawings may not include all changes made during the course of construction and it shall be the Plumbing Subcontractors responsibility to update the as-built documents to include all changes brought forth to the project resulting from bulletins, request for information (RFI's), change orders, etc. The Plumbing Subcontractor may review the Engineers latest computer files for completeness prior to purchase, however the Engineer will not be responsible for updating the computer files.

G. Included with the above shall be a complete drawing list and a standard layering system, which shall be required to be maintained within the as-built Record CAD documents.

H. The Plumbing Subcontractor shall be issued bulletins in the same manner as the original Design Documents described above.

I. The as-built CAD documents required shall be in addition to other requirements stated elsewhere.

1.29 SAMPLES

A. Submit samples as requested by Architect.

1.30 GENERAL PRODUCT REQUIREMENTS

A. Products shall be undamaged and unused at time of installation and shall be complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use.

B. Where available, products shall be standard products of types which have been produced and use previously and successfully on other projects and in similar applications.

C. Where products by their nature and their use are likely to need replacement parts on future date, for maintenance and repair or replacement work, products shall be standard domestically produced products likely to have such parts available to Owner in future.

D. Labels and stamps which are required for observation after installation shall be located on accessible surfaces which, in occupied spaces, are not conspicuous. Other labels and stamps shall be located on concealed surfaces.

1.31 COOPERATION AND WORK PROGRESS

A. The Plumbing work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Plumbing Subcontractor shall cooperate with the Architect, General Contractor, all other Subcontractors and equipment suppliers working at the site. The Plumbing Subcontractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Plumbing Subcontractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Plumbing Subcontractor, shall be assumed by him without any additional cost to the Owner.

C. The Plumbing Subcontractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.

D. The Plumbing Subcontractor shall provide all materials, equipment and workmanship to provide for adequate protection of all Plumbing equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Plumbing Subcontractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Plumbing Subcontractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The Plumbing Subcontractor shall be responsible for unloading all Plumbing equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the General Contractor for hoisting/crane requirements. During construction of the building, the Plumbing Subcontractor shall provide additional protection against moisture, dust accumulation and physical damage of the main service and distribution equipment. This shall include furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.

G. It shall be the responsibility of the Plumbing Subcontractor to coordinate the delivery of the Plumbing equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.

H. The Plumbing Subcontractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.

I. Prior to installation, the Plumbing Subcontractor has the responsibility to coordinate the exact mounting arrangement and location of Plumbing equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Plumbing Subcontractor shall immediately notify the Contractor and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect.

J. The Plumbing Subcontractor shall obtain from the Plumbing and Electrical Subcontractors copies of all shop drawing prints showing the ductwork and piping installation as they will be put in place on the project. These drawings shall be thoroughly checked by the Plumbing Subcontractor be coordinated with the work of other trades so as to prevent any installation conflict.

1.32 INSTALLATION

A. General:

1. Unless specifically noted or indicated otherwise, all equipment and material specified in Division 22 of this specification or indicated on the drawings shall be installed under this Contract whether or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes or material and equipment.
2. The Plumbing Subcontractor shall obtain detailed information from manufacturers of equipment as to proper methods of installation.
3. The Plumbing Subcontractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.
4. The Plumbing Subcontractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.
5. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or cadmium plated finish or of another approved rust-inhibiting coating.
6. Throughout this Section where reference is made to steel channel supports, it shall be understood to mean that the minimum size shall be 1 5/8" mild strip steel with minimum wall thickness of 0.105", similar to Unistrut P1000 or equal products manufactured by Kindorf or Husky Products Co.

1.33 MATERIALS AND WORKMANSHIP

A. All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NEMA, UL, IPCEA, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL listed and labeled.

B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.

C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.

D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.

E. All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

F. The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

1.34 CLEANING

A. This Section of the specifications shall include the cleaning of all equipment on a day-to-day basis and final cleaning of all Plumbing equipment prior to turning building over to the Owner. All necessary cleaning referred to herein shall be cleaned to the satisfaction of the Architect.

1.35 FINAL INSPECTION

A. When all Plumbing work on the project has been completed and is ready for final inspection, such an inspection shall be made. At this time, and in addition to all other requirements in the Contract Documents, the Plumbing Subcontractor, for the work under this Contract, shall demonstrate that the requirements of these specifications have been met to the Architect's satisfaction.

END OF SECTION 220100

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220518	Escutcheons for Plumbing Piping
3.	Section 220719	Plumbing Piping Insulation
4.	Section 221116	Domestic Water Piping
5.	Section 221123	Natural Gas Piping
6.	Section 221316	Sanitary Waste and Vent Piping
7.	Section 221413	Storm Drainage Piping

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A53/A53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping 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: Carbon steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. 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 for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than 6-inch: Galvanized-steel wall sleeves.
   b. Piping 6-inch and Larger: Galvanized-steel wall sleeves.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than 6-inch: Cast-iron wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Piping Smaller Than 6-inch: Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

    b. Piping 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than 6-inch: Galvanized-steel-pipe sleeves.
    b. Piping 6-inch and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

    a. Piping Smaller Than 6-inch: Galvanized-steel-pipe sleeves.
    b. Piping 6-inch and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220517	Sleeves and Sleeve Seals for Plumbing Piping
3.	Section 220719	Plumbing Piping Insulation
4.	Section 221116	Domestic Water Piping
5.	Section 221123	Natural Gas Piping
6.	Section 221316	Sanitary Waste and Vent Piping
7.	Section 221413	Storm Drainage Piping

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.

h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge.
i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220553	Identification for Plumbing Piping and Equipment
3.	Section 221116	Domestic Water Piping
4.	Section 221119	Domestic Water Piping Specialties
5.	Section 223300	Electric Domestic Water Heaters
6.	Section 223400	Fuel Fired Domestic Water Heaters
7.	Section 224300	Plumbing Fixtures

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of meter and gage, from manufacturer.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

2.2 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

D. Connector Type(s): Union joint, rigid, back and rigid, bottom, with unified-inch screw threads.

E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

F. Stem: 0.25 in diameter; stainless steel.

G. Window: Heavy glass.

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus or minus 1 percent of scale range.

2.3 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
1. Standard: ASME B40.200.

2. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Element: Bourdon tube or other type of pressure element.
4. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
5. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Pointer: Dark-colored metal.
7. Window: Heavy glass.
8. Ring: Stainless steel.
9. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

11. Accuracy: Plus or minus 1 percent of scale range.

2.4 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle or Straight unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass.
7. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
3. Case Form: Back angle or Straight unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.

9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.5 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled; cast aluminum or drawn steel; 4 ½-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with ¼-inch or ½-inch, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.7 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with ¼-inch or ½-inch, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with ¼-inch or ½-inch, ASME B1.20.1 pipe threads.

2.8 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: ¼-inch or ½-inch, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.9 TEST-PLUG KITS

A. Furnish one test-plug kit(s) containing one thermometer, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

A. Description: Piping inline-installation device for visual verification of flow.

B. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

C. Minimum Pressure Rating: 150 psig.

D. Minimum Temperature Rating: 200 deg F.

E. End Connections for 2-inch and Smaller: Threaded.

F. End Connections for 2-1/2-inch and Larger: Flanged.

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 direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

J. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Liquid-filled, bimetallic-actuated type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water piping: 0 to 250 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of water service into building shall be the following:

1. Liquid-filled, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:

1. Liquid-filled, direct-mounted, metal case.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING 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.

B. Related Sections:
1. Section 220100 Plumbing General Requirements
2. Section 220519 Meters and Gauges for Plumbing Piping
3. Section 220529 Hangers and Supports for Plumbing Piping and Equipment
4. Section 220553 Identification for Plumbing Piping and Equipment
5. Section 221116 Domestic Water Piping
6. Section 221119 Domestic Water Piping Specialties
7. Section 224300 Plumbing Fixtures

1.2 SUMMARY

A. Section Includes:

1. Ball valves.
2. Gate valves.
3. Check valves.
4. Globe valves.
5. Angle valves.

1.3 REFERENCES

A. ASTM International:
1. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 67 - Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Safe Drinking Water Act:
1. SDWA 1417 - Reduction of Lead in Drinking Water.

1.4 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.

1.5 SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G.

2. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

3. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

4. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views

1.7 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. For drinking water service, provide valves complying with NSF 61.

C. All valves installed on the domestic water distribution system shall comply with SDWA 1417. Exception shall be main shut-off valve at domestic water service entrance that is 2-inches or larger.

D. All valve manufacturers shall demonstrate that valve products have been certified per NSF/ANSI Standard 372.

E. All valves installed on the domestic water system shall have labeling of lead content engraved on the valve body.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

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 operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves 4-inch and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves smaller than 4-inch.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

I. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.2 VALVE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hammond Valve.
2. Milwaukee Valve Company
3. American Valve, Inc
4. NIBCO INC
5. Crane Co.; Crane Valve Group; Stockham Division
6. Red-White Valve Corporation
7. Victaulic
8. Tyco
9. Kennedy
10. Apollo Valve Co.
11. Watts.

2.3 BRONZE BALL VALVES

A. Two-Piece, Bronze Ball Valves with Full Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded or soldered.
f. Seats: PTFE.

g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

2.4 BRONZE GATE VALVES

A. Class 150, NRS, Bronze Gate Valves:
1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: 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, bronze, or aluminum.

2.5 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:
1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: Gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:
1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: Gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

C. Class 250, NRS, Iron Gate Valves:
1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 500 psig.
c. Body Material: Gray iron with bolted bonnet.
d. Ends: Flanged.

e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

D. Class 250, OS&Y, Iron Gate Valves:
1. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 500 psig.
c. Body Material: Gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze, Swing Check Valves with Bronze Disc:
1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:
1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

2.7 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

2.8 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

B. Class 150, Bronze Angle Valves with Bronze Disc:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

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.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

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 valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. If valve applications are not indicated, use the following:

1. Shutoff Service: Gate valves.
2. Throttling Service: Globe or ball valves.

C. 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.

D. Select valves except wafer types with the following end connections:

1. For Copper Tubing, 2-inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, 2-1/2-inch to 4-inch: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, 2-inch and Smaller: Threaded ends.
4. For Steel Piping, 2-1/2-inch to 4-inch: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING 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.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220523	General Duty Valves for Plumbing Piping
3.	Section 220719	Plumbing Piping Insulation
4.	Section 221116	Domestic Water Piping
5.	Section 221125	Natural Gas Piping
6.	Section 221316	Sanitary Waste and Vent Piping
7.	Section 221413	Storm Drainage Piping
8.	Section 221423	Storm Drainage Piping Specialties
9.	Section 223300	Electric Domestic Water Heaters
10.	Section 223400	Fuel Fired Domestic Water Heaters
11.	Section 224300	Plumbing Fixtures

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment 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 plumbing 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.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

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 (Inside Building):

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. Stainless-Steel Pipe Hangers and Supports (Outside Building and in moist environments):

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. 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 stainless 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. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Metallic Coating: Hot-dipped galvanized.
7. Paint Coating: Epoxy.
8. Plastic Coating: Epoxy.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Hot and Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. 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, stainless-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 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: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-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.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 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. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. 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.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2-inch 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.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. 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.

O. 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 4-inch 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 4-inch and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. ¼-inch to 3-inch: 12 inches long and 0.048 inch thick.
    b. 4-inch: 12 inches long and 0.06 inch thick.
    c. 5-inch and 6-inch: 18 inches long and 0.06 inch thick.
5. 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. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9.

C. 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 stainless-steel pipe hangers, and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. 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 ½-inch to 12-inch.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes 4-inch to 24-inch, requiring up to 4-inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes ¾-inch to 12-inch, requiring clamp flexibility and up to 4-inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes ½-inch to 12-inch if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes ½-inch to 4-inch, 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 ¾-inch to 8-inch.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes ½-inch to 8-inch.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes ½-inch to 8-inch.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes ½-inch to 8-inch.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes 3/8-inch to 8-inch.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes 3/8-inch to 3-inch.
12. U-Bolts (MSS Type 24): For support of heavy pipes ½-inch to 12-inch.
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 4-inch to 12-inch, 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 4-inch to 12-inch, 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 2-1/2-inch to 12-inch if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

K. 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 ¾-inch to 12-inch.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers ¾-inch to 12-inch if longer ends are required for riser clamps.

L. 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.

M. 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.

N. 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.

O. 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.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220523	General Duty Valves for Plumbing Piping
3.	Section 221116	Domestic Water Piping
4.	Section 221125	Natural Gas Piping
5.	Section 221316	Sanitary Waste and Vent Piping
6.	Section 221413	Storm Drainage Piping
7.	Section 223300	Electric Domestic Water Heaters
8.	Section 223400	Fuel Fired Domestic Water Heaters

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 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. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. 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-quarters the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. 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: Black.
3. Background Color: White.
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-quarters the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. 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) and 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: 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-quarters the size of principal lettering.

G. Fasteners: Stainless-steel 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; also include 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: Size letters according to ASME A13.1 for piping (minimum of ½-inch).

2.4 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping (minimum of 3/4-inch).
2. Stencil Material: Aluminum.
3. Stencil Paint: Exterior, gloss, acrylic enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
4. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Description: 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: Reinforced grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety 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 GENERAL INSTALLATION REQUIREMENTS

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.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Division 9.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: 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 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Domestic Water Piping

    a. Background: Safety green.
    b. Letter Colors: White.

2. Sanitary Waste and Storm Drainage Piping:

    a. Background Color: Safety white.
    b. Letter Color: Black.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Hot and Cold Water: 1-1/2 inches, round.

2. Valve-Tag Colors:

    a. Cold Water: Natural.
    b. Hot Water: Natural.

3. Letter Colors:

    a. Hot and Cold Water: Black.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

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 insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Storm-water piping.
4. Roof drains and rainwater leaders.
5. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220523	General Duty Valves for Plumbing Piping
3.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
4.	Section 220553	Identification for Plumbing Piping and Equipment
5.	Section 221116	Domestic Water Piping
6.	Section 221413	Storm Drainage Piping
7.	Section 221423	Storm Drainage Piping Specialties
8.	Section 224300	Plumbing Fixtures

1.3 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 insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. 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. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by 2-inches.
2. Jacket Materials for Pipe: 12 inches long by 2-inches.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 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.

1.5 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 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. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ANSI A117.1.

1.6 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.

1.7 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.

1.8 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. Fiberglas: Inorganic, incombustible, molded of heavy density resin bonded inorganic glass fibers.
   1. Density: ASTM C 302.
   2. Operating Temp. Range: ASTM C 411.
   3. Jacket Temp Limitation: ASTM C 1136.
   4. Jacket Permeance: ASTM E 96.

B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

C. Mineral-Fiber, Preformed Pipe Insulation:

   1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. 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).
2. 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. 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).
2. 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. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. 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).
2. 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."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. 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).
2. 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).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
2. Service Temperature Range: 0 to 180 deg F.
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch (1.6-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

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. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. 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).
6. 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. 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. 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).
6. 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. 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: White.
5. 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).
6. 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.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. 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. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. 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.

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

    a. Factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    e. 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.

D. Underground Direct-Buried Jacket: 125-mil-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.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
    1. Width: 3 inches.
    2. Thickness: 11.5 mils.
    3. Adhesion: 90 ounces force/inch in width.
    4. Elongation: 2 percent.
    5. Tensile Strength: 40 lbf/inch in width.
    6. 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.
    1. Width: 3 inches.
    2. Thickness: 6.5 mils.
    3. Adhesion: 90 ounces force/inch in width.
    4. Elongation: 2 percent.
    5. Tensile Strength: 40 lbf/inch in width.
    6. 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. Width: 2 inches.
    2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
1. 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:
1. 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 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.

B. 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.

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. All indoor exposed plumbing piping that requires insulation shall be provided with a PVC jacket.

M. All outdoor exposed plumbing piping that requires insulation shall be provided with an aluminum jacket.

N. 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.

O. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

P. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

Q. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

R. 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 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 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.
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 and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. 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 078413 "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 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 FIBERGLASS INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. 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 factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders 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.

C. 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 cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
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.

3.7 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 Flanges:

1. Install 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 cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges 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 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.

D. 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 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.

3.8 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 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, 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.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. 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.

B. Where PVC jackets are indicated, install with 1-inch 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.

C. 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.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "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 Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. 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, 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 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.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. 1-inch and Smaller: Insulation shall be one of the following:

a. Fiberglass: 1/2-inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2-inch thick.

2. 1 1/4-inch and Larger: Insulation shall be one of the following:

a. Fiberglass: 1-inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-inch thick.

B. Domestic Hot Water:

1. 1-inch and Smaller: Insulation shall be one of the following:

a. Fiberglass: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-inch thick.

2. 1-1/4-inch and Larger: Insulation shall be one of the following:

a. Fiberglass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

C. Storm-water and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Fiberglass: 1-inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Fiberglass: 1-inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch 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 PVC.

3.14 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, Concealed:

1. None.

D. Piping, Exposed:

1. PVC 20 mils thick.
2. Aluminum, Smooth: 0.020 inch 0.024 inch thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220517	Sleeves and Sleeve Seals for Plumbing Piping
3.	Section 220518	Escutcheons for Plumbing Piping
4.	Section 220519	Meters and Gauges for Plumbing Piping
5.	Section 220523	General Duty Valves for Plumbing Piping
6.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
7.	Section 220553	Identification for Plumbing Piping and Equipment
8.	Section 220719	Plumbing Piping Insulation
9.	Section 221119	Domestic Water Piping Specialties
10.	Section 224300	Plumbing Fixtures

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.3 - Malleable Iron Threaded Fittings.
3. ASME B16.4 - Gray Iron Threaded Fittings.
4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
6. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
7. ASME B31.9 - Building Services Piping.
8. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

B. ASTM International:
1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
4. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.
6. ASTM B32 - Standard Specification for Solder Metal.
7. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
8. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
9. ASTM B75 - Standard Specification for Seamless Copper Tube.
10. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
11. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
12. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

E. NSF International:
1. NSF 61 - Standard for Drinking Water System Components - Health Effects.

F. Safe Drinking Water Act:
1. SDWA 1417 - Standard for Lead Free Drinking Water.

1.4 SUBMITTALS

A. Product Data: For the following products:

1. Transition fittings.
2. Dielectric fittings.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

C. All components of the potable domestic water system shall meet the requirements of SDWA-1417.

1.7 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

1.8 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.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

G. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

H. Appurtenances for Grooved-End Copper Tubing:
1. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
2. Mechanical Couplings for Grooved-End Copper Tubing:

a. Copper-tube dimensions and design similar to AWWA C606.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating: 300 psig.

I. Press Fit Connections:
1. Press Fitting: Copper and copper alloy press fittings conforming to ASME B16.18 or ASME B16.22. Sealing elements for press fittings shall be EPDM and factory installed. Press ends shall have SC feature design (leakage path) to assure detection and easy identification of leakage of liquids from inside the system past the sealing element of an unpressed connection.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.

3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

2.5 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. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg F [**150 psig**] [**175 psig**] [**300 psig**].
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 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 copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

H. Install domestic water piping with 0.25 percent slope downward toward drain.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. 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.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

S. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 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 for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: 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. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

G. 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.

H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for 1-1/2-inch and Smaller: Fitting-type coupling.
2. Fittings for 2-inch and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping 2-inch 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 2-inch and Smaller: Use dielectric couplings or **nipples**.

C. Dielectric Fittings for 2-1/2-inch to 4-inch: Use dielectric flanges.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "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 and Less: MSS Type 1, adjustable, steel clevis 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.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. 3/4-inch and Smaller: 60 inches with 3/8-inch rod.
2. 1-inch and 1-1/4-inch: 72 inches with 3/8-inch rod.
3. 1-1/2-inch and 2-inch: 96 inches with 3/8-inch rod.
4. 2-1/2-inch: 108 inches with 1/2-inch rod.
5. 3-inch to 5-inch: 10 feet with 1/2-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   3. 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 2-1/2-inch and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

   1. Piping Inspections:

      a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
      b. During installation, notify authorities having jurisdiction at least one day 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

      c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
      d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

   2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. 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.
c. 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.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 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. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 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. Under-building-slab, domestic water, building-service piping, 3-inch and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K [**ASTM B 88, Type L**]; wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water, building-service piping, 4-inch to 8-inch, shall be the following:
1. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.

F. Under-building-slab, domestic water piping, 2-inch and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

G. Aboveground domestic water piping, 2-inch and smaller, shall be [**one of**] the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; wrought-copper, press-fit fittings; and press-fit joints.
3. Hard copper tube, ASTM B 88, Type L; wrought-copper, grooved end tubing and fittings; and mechanical couplings.

H. Aboveground domestic water piping, 2-1/2-inch to 4-inch, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; wrought-copper, press-fit fittings; and press-fit joints.
3. Hard copper tube, ASTM B 88, Type L; wrought-copper, grooved end tubing and fittings; and mechanical couplings.

3.13 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 2-inch and smaller. Use ball, or gate valves with flanged ends for piping 2-1/2-inch and larger.
2. Throttling Duty: Use ball or globe valves for piping 2-inch and smaller. Use ball valves with flanged ends for piping 2-1/2-inch and larger.
3. 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 221116

SECTION 221119 - DOMESTIC WATER 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220519	Meters and Gauges for Plumbing Piping
3.	Section 220523	General Duty Valves for Plumbing Piping
4.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
5.	Section 220553	Identification for Plumbing Piping and Equipment
6.	Section 221116	Domestic Water Piping
7.	Section 223300	Electric Domestic Water Heaters
8.	Section 223400	Fuel Fired Domestic Water Heaters
9.	Section 224300	Plumbing Fixtures

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers.
6. Hose stations.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Air vents.
12. Trap-seal primer valves.
13. Trap guards.
14. Specialty valves.
15. Flexible connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. 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.

B. NSF Compliance:
1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 VACUUM BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Febco.
2. Watts.
3. Zurn.
4. Conbraco.

B. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Standard: ASSE 1001.
2. Size: 1/4-inch to 3-inch, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.

C. Hose-Connection Vacuum Breakers:
1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.

3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome.

2.3 BACKFLOW PREVENTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Febco.
2. Watts.
3. Zurn.
4. Conbraco.

B. Intermediate Atmospheric-Vent Backflow Preventers:
1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: Refer to Plumbing Drawings.
4. Body: Bronze.
5. End Connections: Solder joint.
6. Finish: Rough bronze.

C. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Size: Refer to Plumbing Drawings.
5. Body: Bronze for 2inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved steel with interior lining that complies with AWWA C550 for 2-1/2-inch and larger.
6. End Connections: Threaded for 2-inch and smaller; flanged or grooved for 2-1/2-inch and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

    a. Valves 2-inch and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves 2-1/2-inch and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

D. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Size: Refer to Plumbing Drawings.
5. Body: Bronze for 2-inch and smaller; cast iron with interior lining that complies with AWWA C550 for 2-1/2-inch and larger.
6. End Connections: Threaded for 2-inch and smaller; flanged for 2-1/2-inch and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

    a. Valves 2-inch and Smaller: Ball type with threaded ends on inlet and outlet.

b. Valves 2-1/2-inch and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

E. Dual-Check-Valve Backflow Preventers:
1. Standard: ASSE 1024.
2. Operation: Continuous-pressure applications.
3. Size: Refer to Plumbing Drawings.
4. Body: Bronze with union inlet.

F. Hose-Connection Backflow Preventers:
1. Operation: Up to 10-foot head of water back pressure.
2. Inlet Size: 1/2-inch or 3/4-inch.
3. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
4. Capacity: At least 3-gpm flow.

G. Backflow-Preventer Test Kits:
1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.4 WATER PRESSURE-REDUCING VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cash Acme.
2. Watts.
3. Zurn.
4. Conbraco.
5. CLA-VAL Automatic Control Valves.

B. Water Regulators:
1. Standard: ASSE 1003.
2. Pressure Rating: Initial working pressure of 150 psig**.**
3. Size: Refer to Plumbing Drawings**.**
4. Body: Bronze for 2-inch and smaller; cast iron for 2-1/2-inch and 3-inch.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for 2-inch and smaller; flanged for 2-1/2-inch and 3-inch.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong International, Inc.
2. Lawler.
3. Leonard.
4. Watts.
5. Symmons.
6. Powers.

B. Water-Temperature Limiting Devices:

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig.
3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Tempered-Water Setting: 120 deg F.
8. Valve Finish: Chrome plated.

C. Primary, Thermostatic, Water Mixing Valves:
1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Tempered-Water Setting: 120 deg F.
8. Valve Finish: Chrome plated.
9. Piping Finish: Copper.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cash Acme.
2. Watts.
3. Zurn.
4. Conbraco.
5. CLA-VAL Automatic Control Valves.

B. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for 2-inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for 2-1/2-inch and larger.
3. End Connections: Threaded for 2-inch and smaller; flanged for 2-1/2-inch and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

a. Strainers 2-inch and Smaller: 0.020 inch.
b. Strainers 2-1/2-inch to 4-inch: 0.045 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.7 HOSE BIBBS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. JR Smith.
3. Watts.
4. Woodford.
5. Zurn.

B. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: ½-inch or ¾-inch threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle**.**
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Loose key.
14. Include two loose keys with each loose-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. JR Smith.
3. Watts.
4. Woodford.
5. Zurn.

B. Nonfreeze Wall Hydrants:
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: 3/4-inch**.**
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

2.9 GROUND HYDRANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. JR Smith.
3. Watts.
4. Woodford.
5. Zurn.

B. Nonfreeze Ground Hydrants:
1. Standard: ASME A112.21.3M.
2. Type: Non-freeze, concealed-outlet ground hydrant with box.
3. Operation: Loose key.
4. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
5. Inlet: 3/4-inch.
6. Outlet: Garden-hose thread complying with ASME B1.20.7.
7. Drain: Designed with hole to drain into ground when shut off.
8. Box: Standard pattern with cover.
9. Box and Cover Finish: Rough bronze.
10. Operating Key(s): Two with each ground hydrant.
11. Vacuum Breaker: ASSE 1011.

2.10 POST HYDRANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. JR Smith.
2. Tyler Pipe; Wade Division.
3. Watts.
4. Woodford.
5. Zurn.

B. Nonfreeze, Draining-Type Post Hydrants:
1. Standard: ASME A112.21.3M.
2. Type: Nonfreeze, exposed-outlet post hydrant.
3. Operation: Loose key.
4. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
5. Casing: Bronze with casing guard.
6. Inlet: 3/4-inch.

7. Outlet: Garden-hose thread complying with ASME B1.20.7.
8. Drain: Designed with hole to drain into ground when shut off.
9. Vacuum Breaker:

    a. Non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

10. Operating Key(s): Two with each loose-key-operation wall hydrant.

C. Non-freeze, Non-draining-Type Post Hydrants:
1. Operation: Lever-piston operating mechanism and non-draining water-storage reservoir, designed without drain.
2. Length: As required for burial of valve below frost line.
3. Inlet: 1-inch threaded.
4. Outlet:

    a. 1-inch outlet and coupling plug for 1-inch hose.
    b. 1-inch by 3/4-inch adapter with non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
    c. Garden-hose thread complying with ASME B1.20.7 on outlet.
    d. 1-inch by 3/4-inch adapter with non-removable, drainable, hose-connection backflow preventer complying with ASSE 1052.
    e. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: 3/4-inch.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: 3/4-inch.
4. Body: ASTM B 62 bronze.
5. Inlet: 3/4-inch threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: 3/4-inch.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: 1/8-inch side outlet with cap.

2.12 WATER-HAMMER ARRESTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. PPP Inc.
3. Watts.
4. JR Smith.
5. Sioux Chief.
6. Zurn.

B. Water-Hammer Arresters:
1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.13 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: 1/2-inch minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: 3/8-inch minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.14 TRAP-SEAL PRIMER DEVICE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. JR Smith.
2. PPP Inc.
3. Watts.
4. Sioux Chief.

B. Supply-Type, Trap-Seal Primer Device:
1. Standard: ASSE 1018.
2. Pressure Rating: 125 psig minimum.
3. Body: Bronze.
4. Inlet and Outlet Connections: 1/2-inch threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: 1/2-inch threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

C. Drainage-Type, Trap-Seal Primer Device:
1. Standard: ASSE 1044, lavatory P-trap with 3/8-inch minimum, trap makeup connection.
2. Size: 1-1/4-inch minimum.
3. Material: Chrome-plated, cast brass.

2.15 TRAP-GUARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Sure Seal.
2. ProSet.
3. JR Smith.

B. Trap-Guard Device:
1. Standard: ASSE 1072.
2. Commercial grade UV and Ozone resistant ABS plastic housing with EPDM rubber diaphragm and soft rubber sealing gasket.
3. Size: Refer to Plumbing Drawings.

2.16 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections 2-inch and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections 2-1/2-inch and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig [**250 psig**].
2. End Connections 2-inch and Smaller: Threaded steel-pipe nipple.
3. End Connections 2-1/2-inch and Larger: Flanged steel nipple.

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 unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

D. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

E. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.

F. Install draining-type post hydrants with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

G. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

H. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

I. Install water-hammer arresters in water piping according to PDI-WH 201.

J. Install air vents at high points of water piping.

K. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

L. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

M. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

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. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check, backflow-prevention assemblies.
5. Dual-check-valve backflow preventers.
6. Water pressure-reducing valves.
7. Primary, thermostatic, water mixing valves.
8. Manifold, thermostatic, water mixing-valve assemblies.
9. Primary water tempering valves.
10. Supply-type, trap-seal primer valves.
11. Trap-seal primer systems.

B. 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. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 221123 - 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220517	Sleeves and Sleeve Seals for Plumbing Piping
3.	Section 220518	Escutcheons for Plumbing Piping
4.	Section 220519	Meters and Gauges for Plumbing Piping
5.	Section 220523	General Duty Valves for Plumbing Piping
6.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
7.	Section 220553	Identification for Plumbing Piping and Equipment
8.	Section 223400	Fuel Fired Domestic Water Heaters

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.

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: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

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.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.

B. 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.

C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

D. Qualification Data: For qualified professional engineer.

E. Welding certificates.

F. Field quality-control reports.

1.6 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.

1.7 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.

1.8 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 Architect and 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.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

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. Stainless-steel flanges and tube with epoxy finish.
b. Buna-nitrile seals.
c. Stainless-steel bolts, washers, and nuts.
d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

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. Operating-Pressure Rating: 0.5 psig.
5. End Fittings: Zinc-coated steel.
6. Threaded Ends: Comply with ASME B1.20.1.
7. 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 2-inch and smaller; flanged ends for 2-1/2-inch 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.

C. 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 2-inch and smaller; flanged ends for 2-1/2-inch 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.

D. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40 [**60**]-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

E. 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 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, 2-inch 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.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1-inch and smaller.
6. Service Mark: Valves 1-1/4-inch to 2-inch shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, 2-1/2-inch 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.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Provide products by one of the following:

a. BrassCraft Manufacturing Company; a Masco company.

b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: stainless steel.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket.
8. CWP Rating: 600 psig.
9. Listing: Valves 1-inch 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.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Provide products by one of the following:

a. BrassCraft Manufacturing Company; a Masco company.
b. Conbraco Industries, Inc.; Apollo Div.
c. Lyall, R. W. & Company, Inc.
d. McDonald, A. Y. Mfg. Co.
e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: stainless steel.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves 1-inch 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. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Provide products by one of the following:

a. Lee Brass Company.
b. McDonald, A. Y. Mfg. Co.
c. Nibco.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.

7. Listing: Valves 1-inch 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.

G. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: 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.
    d. American Production Valve
    e. Flowserve.

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.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves 1-inch 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.

H. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: 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.
    f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
    g. Superior Valves.

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 flange.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves 1-inch 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.

I. Valve Boxes:

1. Cast-iron, two-section box.

2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

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 2-inch and smaller; flanged for regulators 2-1/2-inch and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Provide products by one of the following:

a. Actaris.
b. American Meter Company.
c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
d. Invensys.
e. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-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: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Provide products by one of the following:

a. Actaris.
b. American Meter Company.
c. Eclipse Combustion, Inc.
d. Fisher Control Valves and Regulators; Division of Emerson Process Management.

e. Invensys.
f. Maxitrol Company.
g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-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.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Provide products by one of the following:

a. Canadian Meter Company Inc.
b. Eaton Corporation; Controls Div.
c. Harper Wyman Co.
d. Maxitrol Company.
e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-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: 1 psig [2 psig] [5 psig].

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. Description:

a. Standard: ASSE 1079.

b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 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.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and 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. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

D. Install fittings for changes in direction and branch connections.

E. Install pressure gage downstream from each service regulator.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. 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.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. 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 long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. 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.

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 2-inch 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 sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground, coordinate with gas company.

B. Install metal shutoff valves upstream from service regulators.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, 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 earthquake valves aboveground outside buildings according to listing.

3.7 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. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

F. 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 overtighten.

3.8 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. 1-inch and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. 1-1/4-inch: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. 1-1/2-inch and 2-inch: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. 2-1/2-inch to 3-inch: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. 4-inch and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.9 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.

3.10 LABELING AND IDENTIFYING

A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

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.
d. Color: Gray.

C. Paint exposed, interior 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. 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 gloss.
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 gloss.
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 54 and the International Fuel Gas Code 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.

3.14 OUTDOOR PIPING SCHEDULE

A. 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.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping 1-inch and smaller shall be one of the following:
1. 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.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping 1-inch and smaller shall be one of the following:
1. Steel pipe with steel welding fittings and welded joints.

B. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with steel welding fittings and welded joints.

3.17 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes 2-inch and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves for pipe sizes 2-1/2-inch and larger at service meter shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes 2-inch and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

D. Distribution piping valves for pipe sizes 2-1/2-inch and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, lubricated plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 221123

SECTION 221316 - 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220517	Sleeves and Sleeve Seals for Plumbing Piping
3.	Section 220518	Escutcheons for Plumbing Piping
4.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
5.	Section 220553	Identification for Plumbing Piping and Equipment
6.	Section 221319	Sanitary Waste Piping Specialties
7.	Section 224300	Plumbing Fixtures

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.12 - Cast Iron Threaded Drainage Fittings.
2. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fitting DWV.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fitting DWV.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Pipe.
2. ASTM A888 - Standard Specification for Cast Iron Pipe.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
5. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
6. ASTM B75 - Standard Specification for Seamless Copper Tube.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
9. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.

10. ASTM F1488 - Standard Specification for PVC DWV schedule 40 pipe (solid).

C. Cast Iron Soil Pipe Institute:
1. CISPI 301 – Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
2. CISPI 10 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

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.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect and Owner no fewer than three days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service weight.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 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. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

1. Standard: ASTM C 1277.
2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

2.5 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1173.
b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Dissimilar Pipes: ASTM D 5926, or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.

b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:

a. Standard: AWWA C219.
b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
c. Center-Sleeve Material: Stainless steel.
d. Gasket Material: Natural or synthetic rubber.
e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig minimum at 180 deg F.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 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 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 above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. 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 two 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.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. 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 2 1/2-inch and smaller; 1 percent downward in direction of flow for piping 3-inch and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. 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."

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. 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.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. 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 unless dry seal threading is specified.
2. 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.

E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for2-inch and Smaller: Use dielectric nipples.
3. Dielectric Fittings for 2-1/2-inch to 4-inch: Use dielectric flanges.
4. Dielectric Fittings for 5-inch and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated**.**
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. 1-1/2-inch and 2-inch: 60 inches with 3/8-inch rod.

2. 3-inch: 60 inches with 1/2-inch rod.
3. 4-inch and 5-inch: 60 inches with 5/8-inch rod.
4. 6-inch: 60 inches with 3/4-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. 1-1/4-inch: 72 inches with 3/8-inch rod.
2. 1-1/2-inch and 2-inch: 96 inches with 3/8-inch rod.
3. 2-1/2-inch: 108 inches with 1/2-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves in concrete pit with pit cover flush to grade.
6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections 2-1/2-inch and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping 2-inch and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping 2-1/2-inch and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 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. 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. 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.

3.10 CLEANING AND PROTECTION

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.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping 4-inch 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; hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping 5-inch and larger 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; hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Aboveground, vent piping 4-inch 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; hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Underground, soil, waste, and vent piping 4-inch and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

F. Underground, soil and waste piping 5-inch and larger shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 221316

SECTION 221319 - 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.

B. Related Sections:

1. Section 220100 Plumbing General Requirements
2. Section 220517 Sleeves and Sleeve Seals for Plumbing Piping
3. Section 220518 Escutcheons for Plumbing Piping
4. Section 220529 Hangers and Supports for Plumbing Piping and Equipment
5. Section 220553 Identification for Plumbing Piping and Equipment
6. Section 221319 Sanitary Waste and Vent Piping
7. Section 224300 Plumbing Fixtures

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
1. Backwater valves
2. Cleanouts.
3. Floor drains.
4. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Clean outs
2. Floor drains.

3. Backwater valves.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. 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.

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 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
1. Standard: ASME A112.14.1.
2. Size: Same as connected piping.

3. Body: Cast iron.
4. Cover: Cast iron with bolted access check valve.
5. End Connections: Hub and spigot.
6. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
7. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company; Josam Div.

4. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
5. Size: Same as connected branch.
6. Type: Heavy-duty, adjustable housing.
7. Body or Ferrule: Cast iron.
8. Clamping Device: Not required.
9. Outlet Connection: Threaded.
10. Closure: Brass plug with tapered threads.
11. Adjustable Housing Material: Cast iron with set-screws or other device.
12. Frame and Cover Material and Finish: Nickel-bronze, copper alloy Painted cast iron Polished bronze Rough bronze Stainless steel as selected by Architect.
13. Frame and Cover Shape: Round.
14. Top Loading Classification: Heavy Duty.
15. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
16. Standard: ASME A112.3.1.
17. Size: Same as connected branch.

B. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

c. Tyler Pipe; Wade Div.

4. Standard: ASME A112.36.2M. Include wall access.
5. Size: Same as connected drainage piping.
6. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
7. Closure: Countersunk brass plug.
8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
9. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
10. Wall Access: Round, stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Josam Company; Josam Div.
   b. Tyler Pipe; Wade Div.

4. Standard: ASME A112.6.3.
5. Pattern: Floor drain.
6. Body Material: Gray iron.
7. Seepage Flange: Required.
8. Anchor Flange: Not required.
9. Clamping Device: Required.
10. Outlet: Bottom.
11. Coating on Interior and Exposed Exterior Surfaces: Not required.
12. Sediment Bucket: Required.
13. Top or Strainer Material: Nickel bronze.
14. Top of Body and Strainer Finish: Nickel bronze.
15. Top Shape: Square.
16. Top Loading Classification: Heavy Duty.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Cast iron.
19. Trap Pattern: Deep-seal P-trap.
20. Trap Features: Trap-seal primer valve drain connection.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

    a. 2-inch: 4-inch-minimum water seal.
    b. 2-1/2-inch and Larger: 5-inch-minimum water seal.

C. 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 ½-inch side inlet.

D. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to 4-inch. Use 4-inch 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 for piping 4-inch and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. 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 or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch 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.

F. Install deep-seal traps on floor drains and other waste outlets, if indicated.

G. 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.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

I. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

J. Install wood-blocking reinforcement for wall-mounting-type specialties.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

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.

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. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 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 221319

SECTION 221413 - STORM DRAINAGE 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220517	Sleeves and Sleeve Seals for Plumbing Piping
3.	Section 220518	Escutcheons for Plumbing Piping
4.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
5.	Section 220553	Identification for Plumbing Piping and Equipment
6.	Section 221423	Storm Drainage Piping Specialties

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.12 - Cast Iron Threaded Drainage Fittings.

B. ASTM International:
1. ASTM A74 - Standard Specification for Cast Iron Pipe.
2. ASTM A888 - Standard Specification for Cast Iron Pipe.
3. ASTM F1488 - Standard Specification for PVC DWV schedule 40 pipe (solid).

C. Cast Iron Soil Pipe Institute:
1. CISPI 301 – Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
2. CISPI 10 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF® International.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect and Owner no fewer than three days in advance of proposed interruption of storm-drainage service.
2. Do not proceed with interruption of storm-drainage service without Owner's written permission.

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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service classes.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:
   1. Standards: ASTM C 1277 and CISPI 310.
   2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:
   1. Standards: ASTM C 1277 and ASTM C 1540.
   2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:
   1. Standard: ASTM C 1277.
   2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

   1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
   2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
   3. Unshielded, Nonpressure Transition Couplings:
      a. Standard: ASTM C 1173.
      b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
      c. Sleeve Materials:

         1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
         2) For Dissimilar Pipes: ASTM D 5926, or other material compatible with pipe materials being joined.

   4. Shielded, Nonpressure Transition Couplings:
      a. Standard: ASTM C 1460.
      b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

   5. Pressure Transition Couplings:
      a. Standard: AWWA C219.
      b. Description: Metal, sleeve-type couplings same size as, with pressure rating at least equal to and ends compatible with, pipes to be joined.
      c. Center-Sleeve Material: Carbon steel.
      d. Gasket Material: Natural or synthetic rubber.
      e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

2. Dielectric Flanges:
   a. Description:

      1) Standard: ASSE 1079.
      2) Factory-fabricated, bolted, companion-flange assembly.
      3) Pressure Rating: 150 psig) minimum.
      4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:
   a. Description:

      1) Nonconducting materials for field assembly of companion flanges.
      2) Pressure Rating: 150 psig.
      3) Gasket: Neoprene or phenolic.
      4) Bolt Sleeves: Phenolic or polyethylene.
      5) Washers: Phenolic with steel-backing washers.

4. Dielectric Nipples:
   a. Description:

      1) Electroplated steel nipple complying with ASTM F 1545.
      2) Pressure Rating: 300 psig at 225 deg F.
      3) End Connections: Male threaded or grooved.
      4) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 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 from 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 above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. 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.

K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for all piping.
2. Horizontal Storm-Drainage Piping: 1 percent downward in direction of flow.

M. 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."

N. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
2. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. 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 unless dry seal threading is specified.
2. 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.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron stom piping with the following maximum horizontal spacing and minimum rod diameters:
1. 4-inches: 60 inches with 5/8-inch rod.
2. 6-inches: 60 inches with 3/4-inch rod.
3. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron storm piping every 15 feet .

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
1. Install flanges, in piping 2-1/2-inches and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

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.
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 storm drainage 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 storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage 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. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. 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.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping 6-inches 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; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.

C. Aboveground, storm drainage piping 8-inches and larger 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; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.

D. Underground storm drainage piping 6-inches and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

E. Underground, storm drainage piping 8-inches and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

END OF SECTION 221413

SECTION 221423 – ROOF DRAINS

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. Roof drains.
2. Cleanouts

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Small-Sump, General-Purpose Roof Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC ; Z166. or a comparable product by one of the following:

    a. Jay R. Smith Mfg. Co.
    b. Josam Company.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Dimension of Body: Nominal 11 5/8 inch diameter.
5. Outlet: Bottom.
6. Underdeck Clamp: Required.
7. Dome Material: Cast iron.
8. Vandal-Proof Dome: Required.

2.2 CLEANOUTS

A. Floor Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries, LLC; Z1440 Cleanout Ferrule with Plug or a comparable product by one of the following:

a. Jay R. Smith Mfg. Co.
b. Josam Company.

2. Standard: ASME A112.36.2M, for heavy-duty, adjustable housing cleanouts.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule Material: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Cast-iron plug.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Dura-coated cast-iron.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Heavy Duty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

3.2 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 221423

SECTION 221423 - STORM DRAINAGE 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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220517	Sleeves and Sleeve Seals for Plumbing Piping
3.	Section 220518	Escutcheons for Plumbing Piping
4.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
5.	Section 220553	Identification for Plumbing Piping and Equipment
6.	Section 221413	Storm Drainage Piping

1.2 SUMMARY

A. Section Includes:

1. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Backwater valves.
5. Trench drains.
6. Channel drainage systems.
7. Through-penetration firestop assemblies.
8. Flashing materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:
   1. Standard: ASME A112.6.4, for general-purpose roof drains.
   2. Body Material: Cast iron.
   3. Dimension of Body: Nominal 15-inch diameter.
   4. Combination Flashing Ring and Gravel Stop: Required.
   5. Underdeck Clamp: Required.
   6. Sump Receiver Plate: Required.
   7. Dome Material: Cast iron.
   8. Vandal-Proof Dome: Required.

2.2 CLEANOUTS

A. Test Tees:
   1. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
   2. Size: Same as connected drainage piping.
   3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
   4. Closure Plug: Countersunk.
   5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Wall Cleanouts:
   1. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
   2. Size: Same as connected drainage piping.
   3. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.
   4. Closure: Countersunk brass plug.
   5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
   6. Wall Access: Round, cover plate with screw.

2.3 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M,12 oz./sq. ft..

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to 4-inch. Use 4-inch for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping 4inch and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install test tees in vertical conductors and near floor.

F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

G. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft.lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch 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 the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 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 221423

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

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.

B. Related Sections:
1. Section 220100 Plumbing General Requirements
2. Section 220519 Meters and Gauges for Plumbing Piping
3. Section 220529 Hangers and Supports for Plumbing Piping and Equipment
4. Section 220553 Identification for Plumbing Piping and Equipment
5. Section 221116 Domestic Water Piping
6. Section 221119 Domestic Water Piping Specialties

1.2 SUMMARY

A. Section Includes:
1. Commercial, electric, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of, electric, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including storage tank and supports.
    b. Faulty operation of controls.
    c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

    a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

        1) Storage Tank: Five years.
        2) Controls and Other Components: Three years.

    b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Standard: UL 174.
2. Storage-Tank Construction: Steel, vertical arrangement.

    a. Tappings: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.
    c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: ASSE 1005.
    d. Insulation: Comply with ASHRAE/IESNA 90.1.
    e. Jacket: Steel with enameled finish.
    f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    g. Heating Elements: electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Control: High-temperature-limit cutoff device or system.
    j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

B. Capacity and Characteristics: refer to schedules on the plumbing drawings.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:
   1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
   2. Construction:
      a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
      b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
      c. Air-Charging Valve: Factory installed.
   3. Capacity and Characteristics: refer to schedules on the plumbing drawings.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than ¾-inch with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Heat-Trap Fittings: ASHRAE 90.2.

D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

E. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

F. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

G. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Domestic-Water Heater Mounting: Install electric, domestic-water heaters on domestic-water heater mounting bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping.

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

H. Fill electric, domestic-water heaters with water.

I. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
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 operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

END OF SECTION 223300

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220519	Meters and Gauges for Plumbing Piping
3.	Section 220529	Hangers and Supports for Plumbing Piping and Equipment
4.	Section 220553	Identification for Plumbing Piping and Equipment
5.	Section 221116	Domestic Water Piping
6.	Section 221119	Domestic Water Piping Specialties
7.	Section 221123	Natural Gas Piping

1.2 SUMMARY

A. Section Includes:
1. Gas-fired, tankless, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of gas-fired, tankless, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Gas-Fired, Tankless, Domestic-Water Heaters:

1) Heat Exchanger: Five years.
2) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

A. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.

B. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.

1. Tappings: ASME B1.20.1 pipe thread.
2. Pressure Rating: 150 psig.
3. Heat Exchanger: Copper tubing.
4. Insulation: Comply with ASHRAE/IESNA 90.1.
5. Jacket: Metal, with enameled finish, or plastic.
6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
8. Temperature Control: Adjustable thermostat.

C. Support: Bracket for wall mounting.

D. Capacity and Characteristics: refer to schedules on the plumbing drawings.

1. Electrical Characteristics:

a. Volts: 120.

b. Phase: Single.
c. Hertz: 60.

2. Minimum Vent Diameter: 5 inches.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

B. Heat-Trap Fittings: ASHRAE 90.2.

C. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

D. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

E. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

F. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

G. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

I. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 221123 "Natural-Gas Piping."

D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

H. Install controls for tankless water heaters in accordance with the manufacturers written instructions. Where two or more water heaters are installed together in one zone, controls shall be in accordance with the manufacturers written instructions for two water heater installation.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 221123 "Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
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 operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired, tankless, domestic-water heaters.

END OF SECTION 223400

SECTION 224000 - PLUMBING FIXTURES

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.

B. Related Sections:

1.	Section 220100	Plumbing General Requirements
2.	Section 220518	Escutcheons for Plumbing Piping
3.	Section 220523	General Duty Valves for Plumbing Piping
4.	Section 220529	Hangers And Supports for Plumbing Piping and Equipment
5.	Section 220553	Identification for Plumbing Piping and Equipment
6.	Section 220719	Plumbing Piping Insulation
7.	Section 221116	Domestic Water Piping
8.	Section 221119	Domestic Water Piping Specialties
9.	Section 221316	Sanitary Waste and Vent Piping
10.	Section 221319	Sanitary Waste Piping Specialties

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:
1. Water Closets.
2. Lavatories.
3. Urinals.
4. Sinks.
5. Service sinks.
6. Showers.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

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. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Vitreous-China Fixtures: ASME A112.19.2M.
3. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
2. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
3. Faucets: ASME A112.18.1.
4. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
5. NSF Potable-Water Materials: NSF 61.

6. Supply Fittings: ASME A112.18.1.
7. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for shower faucets:
1. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
2. Faucets: ASME A112.18.1.
3. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Pipe Threads: ASME B1.20.1.
6. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
7. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Manual-Operation Flushometers: ASSE 1037.
4. Brass Waste Fittings: ASME A112.18.2.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: Three year(s) from date of Substantial Completion.

1.7 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 12 of each type.
4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 WATER CLOSET (P1 and P2)

A. Water Closet:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan or a comparable product by one of the following:
a. Kohler Co.
b. American Standard.

2. Description: wall hung, back-outlet, vitreous-china fixture designed for flush-o-meter-valve operation.

a. Style: Close coupled.

1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
2) Height: refer to Architectural drawings.
3) Design Consumption: 1.28 gal./flush.
4) Color: White.

b. Supply: NPS 1-1/2 concealed supply.
c. Style: Flush-o-meter valve.
d. Wall Support: Manufactured waste fitting with seal and fixture bolts.

B. Flushometer:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan or a comparable product by one of the following:
a. Zurn.

2. Flushometer Description: Concealed type, sensor operated type flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper tubing, and polished

chrome-plated finish on exposed parts. Provide with infrared sensor activation with manual over-ride push button.

a. Internal Design: Diaphragm operation.
b. Style: Concealed.
c. Inlet Size: NPS 1 ½-inch back spud.
d. Trip Mechanism: Infrared sensor with manual over-ride.
e. Consumption: 1.28gal./flush.
f. Tailpiece Size: standard length to top of bowl.

C. Toilet Seat:
1. Basis-of-Design Product: Bemis.
2. Acceptable manufacturers offer equal products:
a. American Standard.
b. Kohler.

3. Description: Toilet seat for water-closet-type fixture.

a. Material: Molded, solid plastic.
b. Configuration: closed front without cover.
c. Size: Elongated.
d. Color: White.

D. Fixture Carrier:
1. Basis of Design Product: Josam.
2. Acceptable manufacturers offer equal products:
a. JR Smith.
b. Wade
3. Standard: ASME A112.6.1M.
4. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
5. Water-Closet Mounting Height: handicapped height according to ICC/ANSI A117.1 in ADA locations, standard height in non-ADA locations. Refer to Architectural drawings.

2.2 LAVATORY SYSTEM (P3)

A. Lavatory:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley or a comparable product by one of the following:
a. Acorn.
b. Willoughby
c. Sloan.
2. Description: Wave design, two users, positioned on 30" centers, continuous bowl, preassembled sprayhead module equipped with independent aerators, served by independent IR sensor. Operating range is 20–80 PSI. Flow restrictor to keep flow rate constant at all pressures. Flow rate: 0.5 GPM.

a. Body Material: Terreon solid surface polyester resin.

b. Maximum Flow Rate: 0.5 gpm, unless otherwise indicated.

2.3 LAVATORIES (P4)

A. Lavatory:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley or a comparable product by one of the following:
   a. Willoughby
   b. Sloan.
2. Description: Wall hung, 4-inch centers, Terreon solid surface material.
   a. Type: Wall-hung.
   b. Faucet Hole Punching: Three holes, 4-inch (102-mm) centers.
   c. Color: as selected by Architect.
   d. Faucet: Lavatory for separate drain.
   e. Supplies: 3/8-inch chrome-plated copper with stops.
   f. Drain: Grid with offset waste.
   g. Drain Piping: chrome-plated, cast-brass P-trap; 1-1/2, 0.045-inch-thick tubular brass waste to wall; and wall escutcheon.

B. Faucet:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago or a comparable product by one of the following:
   a. T&S.
   b. Symmons
2. Description: manual activated, chrome plated metered faucet. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

   a. Body Material: Commercial, solid brass.
   b. Finish: Polished chrome plate.
   c. Maximum Flow Rate: .5 gpm.
   d. Centers: 4 inches.
   e. Mounting: Deck, exposed.
   f. Valve Handle: None, metered.
   g. Inlet(s): 3/8 tubing.
   h. Spout: Rigid.
   i. Spout Outlet: Laminar flow.
   j. Operation: metered.
   k. Drain: Chrome grid.

C. Fixture Support:
1. Fixture shall be bolted to CMU wall, provide with bolts, nuts and washers and base plate.

2.4 URINALS (P-5)

A. Urinals:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler.

2. Description: Accessible, wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.

    a. Type: Washout with extended shields.
    b. Strainer or Trapway: Separate removable strainer with integral trap.
    c. Design Consumption: 0.125 gal./flush.
    d. Color: White.
    e. Supply Spud Size: ¾-inch.
    f. Outlet Size: 2-inch.
    g. Fixture Support: Urinal chair carrier.

B. Flushometer:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Sloan.

2. Description: Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

    a. Internal Design: diaphragm operation.
    b. Style: Concealed.
    c. Inlet Size: 3/4-inch top spud.
    d. Trip Mechanism: infrared sensor activated.
    e. Consumption: .125gal./flush.
    f. Tailpiece Size: standard length to top of bowl.

C. Fixture Support::
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.5 SHOWER FAUCETS (P6 and P7)

A. Shower Faucets:
1. Description: chase mounted three piece panel shower assembly.
2. Shower:
    a. Body Material: Stainless steel.
    b. Finish: stainless steel.
    c. Soap dish.
    d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
    e. Mounting: Concealed.
    f. Operation: push button.
    g. Supply Connections: ½-inch.

h. Shower Head:
   1) Standard: ASME A112.18.1/CSA B125.1.
   2) Type: fixed direction spray.
   3) Shower Head Material: Metallic with chrome-plated finish.
   4) Spray Pattern: Adjustable.

2.6 LAVATORIES (P8)

A. Lavatory:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley or a comparable product by one of the following:
      a. Acorn.
      b. Willoughby
      c. Sloan.
   2. Description: Wall hung, 4-inch centers, Terreon solid surface material.
      a. Type: Wall-hung.
      b. Faucet Hole Punching: Three holes, 4-inch (102-mm) centers.
      c. Color: as selected by Architect.
      d. Faucet: Lavatory for separate drain.
      e. Supplies: 3/8-inch chrome-plated copper with stops.
      f. Drain: Grid with offset waste.
      g. Drain Piping: chrome-plated, cast-brass P-trap; 1-1/2, 0.045-inch-thick tubular brass waste to wall; and wall escutcheon.

B. Faucet:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Chicago or a comparable product by one of the following:
      a. T&S.
      b. Symmons
   2. Description: manual activated, chrome plated single lever faucet. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

      a. Body Material: Commercial, solid brass.
      b. Finish: Polished chrome plate.
      c. Maximum Flow Rate: 1.5 gpm.
      d. Centers: 4 inches.
      e. Mounting: Deck, exposed.
      f. Valve Handle: single lever.
      g. Inlet(s): 3/8 tubing.
      h. Spout: Rigid.
      i. Spout Outlet: Laminar flow.
      j. Operation: manual.
      k. Drain: Chrome grid.

C. Fixture Support:
   1. Fixture shall be bolted to CMU wall, provide with bolts, nuts and washers and base plate.

2.7 MOP BASIN (P9)

A. Service Basins: Plastic, floor mounted.
1. Fixture:

a. Standard: IAPMO/ANSI Z124.6.
b. Material: Molded stone.
c. Nominal Size: 24 by 24 by 10 inches.
d. Rim Guard: On all top surfaces.
e. Color: white.
f. Drain: Grid with 3-inch stainless steel outlet.

2. Mounting: On floor and flush to wall.
3. Faucet:
a. Manual type two lever.
b. Standard: ASME A112.18.1/CSA B125.1.
c. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Widespread.
5. Body Material: Commercial, solid brass.
6. Finish: Chrome plated.
7. Maximum Flow Rate: 2.2 gpm.
8. Handle(s): Lever.
9. Mounting Type: Back/wall, exposed.
10. Spout Type: Rigid, solid brass with wall brace.
11. Vacuum Breaker: Integral to faucet.
12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.8 COMBINATION EMERGENCY EYEWASH DRENCH SHOWERS (P10)

A. Accessible, Plumbed Emergency Shower with Eyewash Combination Units:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
a. Speakman Company.

2. Piping:

a. Material: stainless steel.
b. Unit Supply: 1-1/4-inch minimum.
c. Unit Drain: Outlet at back or side near bottom.

3. Shower:

a. Capacity: Not less than 20 gpm for at least 15 minutes.
b. Supply Piping: 1-inch with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Pull rod.
d. Shower Head: 8-inch- minimum diameter, chrome-plated brass or stainless steel.
e. Mounting: Pedestal.

4. Eyewash Unit:

a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
b. Supply Piping: ½-inch with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Paddle.
d. Spray-Head Assembly: Two receptor-mounted spray heads.
e. Receptor: Chrome-plated brass or stainless-steel bowl.
f. Mounting: Attached shower pedestal.

2.9 CONCESSION SINK (P11)

A. Sink: Accessible, one bowl, countertop mounted, stainless steel.
1. Basis-of-Design Product: Elkay.

2. Description: One-bowl, counter-mounting, 18 gauge stainless-steel sink, 3-1/2-inch drain opening, 3 hole punch, 8-inch centers.

B. Sink Faucet:
1. Basis-of-Design Product: Symmons.
2. Acceptable manufacturers offer equal products:
a. Moen.

3. Description: Faucet, three-hole fixture. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 2.2 gpm, unless otherwise indicated.
d. Centers: 8 inches.
e. Mounting: Deck.
f. Handle(s): single-lever extra long handle.
g. Inlet(s): NPS 3/8 tubing.
h. Spout Type: swing spout.
i. Spout Outlet: Laminar flow.
j. Vacuum Breaker: Not required.
k. Operation: Manual.

2.10 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Fittings:

1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

a. Operation: loose key stop.

3. Risers:
   a. Size: ½-inch for sinks.
   b. Material: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

2.11 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset tailpiece for accessible lavatories.

C. Drain: Grid type with 1-1/2-inch offset tailpiece for accessible sinks.

D. Drain: Grid type with 1-1/2-inch straight tailpiece for standard sinks.

E. Trap:
   1. Size: 1-1/2-inch for sinks.
   2. Size: 1-1/2-inch for lavatories.
   3. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated-brass or -steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

C. Install counterset fixtures with semicast trap with tubular waste piping.

D. Install fixtures level and plumb according to roughing-in drawings.

E. Install water-supply piping with shock absorbers per manufacturer's recommendations with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

F. Install brass trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

G. Install toilet seats on water closets.

H. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

I. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

J. Install shower flow-control fittings with specified maximum flow rates in shower arms.

K. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

L. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

M. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 230100 – MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 1, General Requirements, shall be included in, and made part of, this Section.

1.2 DESCRIPTION OF WORK

A. Carefully examine all of the Contract Documents, criteria sheets and all other Sections of the specifications for requirements which affect work under this Section, whether or not such work is specifically mentioned in this Section.

B. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation, of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the HVAC Subcontractor for the installation of all work as shown on the drawings and as specified hereinunder.

D. Coordinate work with that of all other Trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

1.3 RELATED WORK

A. For work to be included as part of this Section, to be furnished and installed by the HVAC Subcontractor, refer to the following Sections:

1.	Section 230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
2.	Section 230553	IDENTIFICATION FOR HVAC EQUIPMENT
3.	Section 230593	TESTING, ADJUSTING, AND BALANCING FOR HVAC
4.	Section 233113	METAL DUCTS
5.	Section 233300	AIR DUCT ACCESSORIES
6.	Section 233423	HVAC POWER VENTILATORS
7.	Section 233713	DIFFUSERS, REGISTERS, AND GRILLES
8.	Section 238239	UNIT HEATERS

B. For work related to, and to be coordinated with the HVAC work, but not included in this Section and required to be performed under other designated Sections, see the following:

1. Division 4 Section “Masonry Work” for HVAC construction.
2. Division 7 Section “Firestopping”.
3. Division 7 Section “Caulking, Flashing, Waterproofing, Roofing and setting of Roof Drains”.
4. Division 8 Section “Access Panels”.
5. Division 9 Section “Painting”.

1.4 REFERENCES

A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards and Utility Company Regulations, latest editions.

B. In case of difference between Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations and the Contract Documents, the HVAC Subcontractor shall promptly notify the Architect in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the HVAC Subcontractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect/Owner.

E. Applicable Codes and Standards shall include all State Laws, Local Ordinances, Utility Company Regulations, and the applicable requirements of the latest adopted edition of the following Codes and Standards, without limiting the number, as follows:

1. National Electrical Code (NEC)
2. Environmental Protection Agency (EPA)
3. Connecticut - Environmental Air Quality Protection Agency
4. Connecticut - Energy Code
5. Connecticut - Building Code (Latest Adopted Edition), including all adopted Connecticut - Supplements
6. Connecticut - Fire Prevention Regulations and Elevator Regulations
7. Local Ordinances, Regulations of the Local Building Department and Fire Department
8. International Mechanical Code
9. Recommendations of the National Fire Protection Association (NFPA), latest applicable edition adopted, in general and in particular:
   a. Life Safety, NFPA 101
   b. HVAC, NFPA 90A, 90B
   c. Equipment, NFPA 96
10. Recommendations of ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers), including:

a. ASHRAE 90.1
b. ANSI/ASHRAE 62-Ventilation for Acceptable Indoor Air Quality
c. ANSI/ASHRAE 15-Safety Code for Mechanical Refrigeration

F. ANSI/ASHRAE 55-Thermal Environmental Conditions for Human OccupancyIn these specifications, references made to the following Industry Standards and Code Bodies are intended to indicate the latest volume or publication of the Standard. All equipment, materials and details of installation shall comply with the requirements and latest revisions of the following Bodies, as applicable:

ANSI:	American National Standards Institute
ASTM:	American Society of Testing Materials
FM:	Factory Mutual
UL:	Underwriters' Laboratories
IRI:	Industrial Risk Insurers
ISO:	Insurance Services Office
NBS:	National Bureau of Standards
NSC:	National Safety Council

G. HVAC Subcontractor for the work in his scope of work shall give all necessary notices, obtain all permits, pay all governmental taxes, fees and other costs in connection with his work; file for necessary approvals with the jurisdiction under which the work is to be performed. HVAC Subcontractor shall obtain all required Certificates of Inspection for his respective work and deliver same to the Architect before request for acceptance of his portion of work is made and before final payment.

1.5 QUALITY ASSURANCE

A. The manufacturers listed within these specifications have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified.

B. HVAC Subcontractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner.

C. Where equipment of a substitute manufacturer differ from that specified and require different arrangement or connections from those shown, it shall be the responsibility of the Subcontractor responsible for the substitution to modify the installation of the equipment/system to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the HVAC Subcontractor shall submit drawings showing the proposed, substitute installation. If the proposed installation is accepted, the HVAC Subcontractor shall make all necessary changes in all affected related work provided under his and other Sections including location of roughing-in connections by other Trades, supports, etc. All changes shall be made at no increase in the Contract amount or additional cost to the Owner. The General Contractor shall be responsible to assure that the Subcontractor responsible for the substitution bears the cost arising to all other Trades as a result of the substitution.

D. Unless specifically indicated otherwise, all equipment and materials required for installation under these specifications shall be new, unused and without blemish or defect. Equipment and materials shall be products which will meet with the acceptance of the Authorities having

jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed and/or labeled by FM or UL or another testing laboratory, the products shall be so listed and/or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.

1.6 WARRANTY

A. Attention is directed to provisions of the General Requirements and Supplementary General Requirements regarding and warranties for work under this Contract.

B. All warranties shall begin on the Date of Substantial Completion of the entire project or the Owner's acceptance of the workmanship and/or material covered by the warranty, whichever is later. The warranty coverage shall continue for the specified period. Refer to individual specification sections for warranty period. If no specific warranty period is specified, the warranty shall extend for a minimum of 365 days.

C. Manufacturers shall provide their standard warranties for work under the HVAC Trades. However, such warranties shall be in addition to, and not in lieu of, all other liabilities which the manufacturer and HVAC Subcontractor may have by law or by other provisions of the Contract Documents.

D. All materials, items of equipment and workmanship furnished under the HVAC Section shall carry the standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the HVAC Subcontractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.

E. The HVAC Subcontractor shall warranty that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

F. Upon receipt of notice from the Owner or Architect of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by the HVAC Subcontractor for his work or any other work affected by the failure(s).

G. HVAC Subcontractor shall furnish, before the final payment is made, a written warranty covering the above requirements in accordance with the General Requirements.

1.7 DEFINITIONS

A. Words in the singular shall also mean and include the plural, wherever the context so indicates, and words in the plural shall mean the singular, wherever the context so indicates.

B. Wherever the terms "shown on drawings" are used in the specifications, they shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

C. Wherever the term "provide" is used in the specifications it will mean "furnish" and "install", "connect", "apply", "erect", "construct", or similar terms, unless otherwise indicated in the specifications.

D. “Work”: Labor, materials, equipment, apparatus, controls and accessories required for proper and complete installation.

E. “Concealed”: Embedded in masonry or other construction; or installed in furred spaces, trenches or crawl spaces; or installed within double partitions or hung ceilings; or in enclosures.

F. “Exposed”: Visible to building occupants, excluding mechanical room and utility tunnel locations.

G. “Acceptable equivalent” or “Equal”: Of weight, size, design, capacity and efficiency to meet requirements specified and shown, and of acceptable manufacturer, as determined in the opinion of the Architect.

H. “Acceptable”: Acceptable, as determined in the opinion of the Architect.

I. “Contractor”: General Contractor.

J. “Named” Product: Manufacturer’s name for product, as recorded in published documents of latest issue as of date of Contract Documents. Obtain Architect’s permission before using products of later or earlier model.

K. Wherever the term "material" is used in the specifications it will mean any "product", "equipment", "device", "assembly", or "item" required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.

L. The terms "approved", or "approval" shall mean the written approval of the Architect.

M. The term "Contract Documents" shall mean the entire set of Drawings and Specifications as listed in the Table of Contents of the General Conditions including all bound and unbound material and all items officially issued to date such as addenda, bulletins, job modifications, etc.

N. The term "specification" shall mean all information contained in the bound or unbound volume, including all "Contract Documents" defined therein, except for the drawings.

O. The terms "directed", "required", "permitted", "ordered", "designated", "prescribed", and similar words shall mean the direction, requirement, permission, order, designation or prescription of the Architect; the terms "approved", "acceptable", "satisfactory", and similar words shall mean approved by, acceptable or satisfactory to the Architect; and, the terms "necessary", "reasonable", "proper", "correct", and similar words shall mean necessary, reasonable, proper or correct in the judgment of the Architect.

P. "Accessible" indicates ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, etc. to gain access. "Accessible ceiling" indicates acoustic tile type hung ceilings. Concealed spline or sheetrock ceilings with access panels shall not be considered accessible ceilings.

Q. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction or in crawl spaces.

R. "Exposed" means not installed underground or "concealed" as defined above.

S. "HVAC Subcontractor" refers to the Subcontractor responsible for furnishing and installation of all work indicated on the HVAC drawings and in the HVAC specifications.

T. "Architect" shall refer to the Architect: “TLB Architecture, LLC” and/or the Engineer "Innovative Engineering Services, LLC.”

U. "Owner" shall refer to the Owner or designated representative.

V. "Other Work Contractor" (O.W.C.) refers to the Contractor(s), or Subcontractor(s) performing work under other Sections of the Contract Documents.

1.8 THE SUBCONTRACTOR

A. The HVAC Subcontractor shall visit the site of the proposed new facility and base his bids from his own site examinations and estimates. The HVAC Subcontractor shall not hold the Architect, Engineer, Owner or their agents or employees responsible for, or bound by, any schedule, estimate or of any plan thereof. The HVAC Subcontractor shall study the Contract Documents included under this Contract to determine exactly the extent of work provided under this Contract, as well as to ascertain the difficulty to be encountered in performing the work, in installing new equipment and systems and coordinating the work with the other Trades and existing building conditions.

B. The HVAC Subcontractor shall faithfully execute his work according to the terms and conditions of the Contract and specifications, and shall take all responsibility for and bear all losses resulting to him in the execution of his work.

C. The HVAC Subcontractor shall be responsible for the location and performance of work provided under his Contract as indicated on the Contract Documents. All parties employed directly or indirectly by the HVAC Subcontractor shall perform their work according to all the conditions as set forth in these specifications.

D. The HVAC Subcontractor shall furnish all materials and do all work in accordance with these specifications, and any supplementary documents provided by the Architect. The work shall include everything shown on the drawings and/or required by the specifications as interpreted by the Architect, regardless of where such information is indicated in the Contract Documents (Architectural, Electrical, Plumbing, Fire Protection, etc.). Unless specifically indicated otherwise, all work and materials furnished and installed shall be new, unused and of the best quality and workmanship. The HVAC Subcontractor shall cooperate with the Architect so that no error or discrepancy in the Contract Documents shall cause defective materials to be used or poor workmanship to be performed.

1.9 COORDINATION OF WORK

A. The HVAC Subcontractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the HVAC work.

B. Coordinate work with that of all other Trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

C. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, HVAC Subcontractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of the HVAC Subcontractor or that of any other trade caused by the HVAC Subcontractor's neglect, shall be made by him at his own expense, to the Architect's satisfaction.

D. The HVAC Subcontractor must include in his bid sufficient dollar amounts to coordinate the work of this Contract. This project is complex and will require additional time to coordinate all Trades and allow implementation of the Owners Standards and maintenance serviceability requirements. This requirement shall include, but not be limited to, producing the coordination drawings, as many times and as many drawings as required, to ensure serviceability of equipment, as approved by the Architect.

E. Locations of ductwork and piping distribution, equipment, systems, etc. shall be adjusted to accommodate the work with interferences anticipated and encountered. The HVAC Subcontractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system component. Accurate measurements and coordination drawings shall be completed to verify dimensions and characteristics of the various systems installations.

F. Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam piping shall normally have the right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.

G. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. The HVAC Subcontractor shall provide elbows, fittings, offsets in ductwork and piping, etc. as required for his work to affect these offsets, transitions and changes in direction.

H. All work shall be installed in a way to permit removal (without damage to other parts) all other system components provided under this Contract requiring periodic replacement or maintenance. All work shall be done to allow easy access for maintaining equipment. The Owner and Engineer will require proof via the preparation of large scale sections and part plans that pull and junction boxes, etc. are accessible after the work is completed. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect.

I. The Contract Drawings are diagrammatic only intending to show general runs and locations of the ductwork, piping, equipment, systems equipment, etc. and not necessarily showing all required offsets, details and accessories and equipment to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation which will afford maximum accessibility for operation, maintenance and headroom.

J. Where discrepancies in scope of work as to what Trade provides items, such conflicts shall be reported to the Architect during bidding and prior to signing of the Contract. If such action is not taken, the HVAC Subcontractor shall furnish such items as part of his work as necessary, for complete and operable systems and equipment, as determined by the Architect.

K. The HVAC Subcontractor shall coordinate the installation of all equipment.

L. Where drawing details, plans, specification requirements and/or scheduled equipment capacities are in conflict or equipment are shown to be different between plans and/or between plans and riser diagrams, details or specifications, the most stringent requirement will be included in the Contract. HVAC systems and equipment called for in the specification and/or shown on the drawings shall be provided under this Contract as if it were required by both the drawings and specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.

M. Any equipment shown on the HVAC and/or Architectural drawings to be provided with services shall be included under this Contract as applicable to make equipment complete and operable. Additional equipment, etc., shall be provided to accomplish the above requirement, as required, all as part of this Contract, at no extra cost to the Owner. This requirement necessitates that the HVAC Subcontractor review the Architectural drawings and the drawings of other Trades during bidding to ascertain the extent of all requirements, and interface between the Trades and scope of work.

N. The HVAC Subcontractor shall coordinate his work with other Trades' work so that all equipment and systems can be easily, safety and properly serviced and maintained. It is imperative that service personnel can safely access all equipment. Provide safety rails, steps, ladders, valve chains, handle extensions, etc. as required, in addition to the ones shown on the drawings, to ensure safe and easy access to all equipment is provided in a manner approved by the Architect.

1.10 GIVING INFORMATION

A. HVAC Subcontractor shall keep himself fully informed as to the shape, size and position of all openings required for his apparatus and shall give information to the General Contractor and other Subcontractors sufficiently in advance of the work so that all openings may be built in advance.

1.11 EQUIPMENT AND MATERIALS

A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, but readily accessible for inspection by the Architect until installed. All items subject to moisture damage such as controls shall be stored in dry, heated spaces.

B. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned and polished thoroughly and turned over to the Owner in a condition satisfactory to the

Architect. Damage or defects that develop before acceptance of the work shall be made good at the HVAC Subcontractor's expense.

C. The HVAC Subcontractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.

D. Manufacturer's directions shall be followed completely in the delivery, storage, protection and installation. Promptly notify the Architect in writing of any conflict between any requirements of the Contract Documents and the manufacturer's directions. Obtain the Architect's written instructions before proceeding with the work. Should HVAC Subcontractor perform any work that does not comply with the manufacturer's directions or written instructions from the Architect, he shall bear all costs arising in correcting any deficiencies that should arise.

E. All equipment of one type shall be the products of one manufacturer.

F. Equipment prepurchased by the General Contractor on behalf of the Owner or by the Owner himself, if assigned to the HVAC Subcontractor, shall be received, installed, tested, etc., as if the equipment was purchased by the HVAC Subcontractor. All guarantees, service contracts, etc., shall be the same as for all other equipment provided under this Contract.

1.12 USE OF PREMISES

A. The HVAC Subcontractor shall confine all apparatus, storage of materials and construction to the limits as directed by the Architect and he shall not encumber the premises with his materials. The HVAC Subcontractor shall be held responsible for repairs, patching, or cleaning arising from any unauthorized use of premises.

B. Notwithstanding any approvals or instructions which must be obtained by the HVAC Subcontractor from the Architect in connection with the use of the premises, the responsibility for the safe working conditions at the site shall remain that of the HVAC Subcontractor. The Architect, Engineer or Owner shall not be deemed to have any responsibility or liability in connection with safe working conditions at the site.

1.13 PROTECTION

A. Materials, equipment, etc., shall be properly protected during construction and all conduit openings shall be temporarily closed so as to prevent obstruction and damage. Post notice prohibiting the use of all systems provided under the HVAC Contract, prior to completion of work and acceptance of all systems by the Owner except as otherwise, instructed by Architect. Take precautions to protect all materials furnished from damage and theft.

B. The HVAC Subcontractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or HVAC systems provided under his Contract.

1.14 DAMAGE TO OTHER WORK

A. The HVAC Subcontractor shall be held responsible and shall pay for all damages caused by his work to the building structures, equipment, systems, etc., and all work and finishes installed under this Contract. Repair of such damage shall be done by the General Contractor at the expense of the HVAC Subcontractor, to the Architect's satisfaction.

1.15 CORRECTION OF WORK

A. The HVAC Subcontractor shall promptly correct all work provided under his Contract and rejected by the Architect as defective or as failing to conform to the Contract Documents, whether observed before or after completion of work, and whether or not fabricated, installed or completed.

1.16 EXTRA WORK

A. No claim for extra work will be allowed unless it is authorized by the Architect before commencement of the extra said work.

1.17 TOUCH-UP PAINTING

A. All equipment and systems shall be thoroughly cleaned of rust, splatters and other foreign matter of discoloration leaving every part of all systems in an acceptable prime condition. The HVAC Subcontractor for the work under his Contract shall refinish and restore to the original condition all equipment which has sustained damage to the manufacturer's prime and finish coats of paint and/or enamel during the course of construction, regardless of the source of damage.

1.18 PARTS LIST AND INSTRUCTIONS FOR OPERATION AND MAINTENANCE

A. The HVAC Subcontractor shall thoroughly instruct the Owner, to the complete satisfaction of the Architect, in the proper operation of all systems and equipment provided by him. The HVAC Subcontractor shall make arrangements, via the Architect, as to whom the instructions are to be given in the operation of the basic and auxiliary systems and the period of time in which they are to be given. The Architect shall be completely satisfied that the Owner has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the HVAC Subcontractor to the Owner's representative, then the HVAC Subcontractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this specification has been complied with.

B. HVAC Subcontractor shall submit to the Architect for approval, the required typed sets (see General Conditions and Division 1) bound neatly in loose-leaf binders, of all instructions for the installation, operation, emergency operation, start-up, care and maintenance of all equipment and systems (including instructions for the ordering and stocking of spare parts for all equipment installed under this Contract). The lists shall include part numbers and suggested supplier. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.

C. Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub-index for each section shall also be provided. The methodology of setting-up the manuals shall be submitted to the Architect and Owner for review prior to final submission of manuals.

1.19 MANUFACTURER'S REPRESENTATIVE

A. The HVAC Subcontractor shall provide, at the appropriate time or as directed by Architect, the on-site services of a competent factory trained Engineer of the manufacturer of specific equipment, to inspect, test, adjust and place in proper operating condition any and all items of the same manufacturer. No additional compensation will be allowed for such services. A written report shall be issued by the particular manufacturer with his findings for the Architect's record.

1.20 COORDINATION DRAWINGS

A. Before materials are purchased, fabricated or work is begun, each Subcontractor shall prepare and obtain approval of coordination drawings, and sections for all floors/areas, including buried system/services, resulting in one (1) set of all-Trade-composite at 3/8" scale drawings, showing the size and location of all equipment, in the manner described hereinunder General Requirements. Architects review and approval of coordination drawings must be obtained prior to any fabrication or installation of any equipment or systems.

B. The coordination drawings shall be generated from a computer CAD program compatible with AutoCAD Release 2013, in DWG or DXF format. The HVAC Subcontractor shall take the lead, supervise, and coordinate production of coordinated layout drawings, to show and coordinate all equipment. These drawings shall then be circulated to the HVAC Subcontractor so that he can indicate all his work as directed by the General Contractor and Architect and as required, to result in a fully coordinated installation.

C. All costs associated with all aspects of coordination drawings, regardless as to how long they take to produce and how many times they have to be redrawn, shall be borne by the HVAC Subcontractor.

D. The HVAC Subcontractor may purchase the HVAC AutoCAD computer drawing files from the HVAC Contract set on disk or via modem from the Engineer at the nominal cost of $500.00, if he so chooses.

1.21 RECORD DRAWINGS/AS-BUILT DRAWINGS

A. The HVAC Subcontractor shall maintain current at the site a set of his drawings on which he shall accurately show the actual installation of all work provided under his Contract indicating hereon any variation from the Contract Drawings, in accordance with the General Conditions and Division 1. Changes, whether resulting from formal change orders or other instructions issued by the Architect, shall be recorded. Include changes in sizes, location, and dimensions of equipment, etc.

B. The HVAC Subcontractor shall indicate progress by coloring-in equipment and associated appurtenances exactly as they are erected. This process shall incorporate both the changes noted above and all other deviations from the original drawings whether resulting from job conditions encountered or from any other causes.

C. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed. They shall be inspected periodically by the Architect and Owner and they shall be corrected immediately if found either inaccurate or incomplete. This procedure is mandatory.

D. At the completion of the job, these prints shall be submitted to the General Contractor and then to the Architect for final review and comment. The prints will be returned with appropriate comments and recommendations. These corrected prints, together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of As-built Record Drawings.

E. The Subcontractor shall be responsible for generating as-built Record Drawings utilizing CAD based documents in AutoCAD Release 2013 DWG or DXF format. A bound set of plans, as well as the computer files, on disk, shall be turned over to the Architect for review. After acceptance of the as-built documents by the Architect, the HVAC Subcontractor shall make any corrections necessary to the as-built documents and prepare one reproducible set of drawings as well as bound blueprint set(s) (quantity as determined by the Architect) for distribution to the Owner via the Architect.

F. The HVAC Subcontractor may use the computer drawing files used for coordination drawings or purchase the Engineers most recently updated computer drawing files at a nominal charge of $500.00 per drawing file. The updated drawings may not include all changes made during the course of construction and it shall be the HVAC Subcontractors responsibility to update the as-built documents to include all changes brought forth to the project resulting from bulletins, request for information (RFI's), change orders, etc. The HVAC Subcontractor may review the Engineers latest computer files for completeness prior to purchase, however the Engineer will not be responsible for updating the computer files.

G. Included with the above shall be a complete drawing list and a standard layering system, which shall be required to be maintained within the as-built Record CAD documents.

H. The HVAC Subcontractor shall be issued bulletins in the same manner as the original Design Documents described above.

I. The as-built CAD documents required shall be in addition to other requirements stated elsewhere.

1.22 SUBMITTALS

A. Prepare and submit shop drawings in accordance with the requirements hereinbefore specified, and with Division 1 Section “Submittal Procedures” in the manner described therein, modified as noted hereinafter.

B. The selection and intention to use a product specified by name shall not excuse the need for timely submission of shop drawings for that product.

C. Prior to submitting shop drawings, submit for review preliminary list of intended or proposed manufacturers for all items for which shop drawings are required.

D. Submission of shop drawings of an unnamed manufacture or shop drawings at variance with the Contract Documents is not a proper request for substitution.

E. Samples that are submitted in lieu of shop drawings shall be clearly identified and shall be submitted in duplicate. Only one sample will be returned and that accepted sample shall be kept available at appropriate job site office. Accepted sample retained by Architect will be kept available at Architect's home office.

F. Upon completion of shop drawing review, shop drawings will be returned, marked with one of following notations: No Exception Taken, Revise as Noted, Revise and Resubmit, or Rejected. Only products whose shop drawings are marked "No Exception Taken" or "Revise as Noted" shall be used on the project.

G. CT HPB documentation:

1. For all installed products and materials of the Section, submit the following information:
a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or pre-consumer recycled content in the supplied product(s).
c. Indication of location (city, state) of the manufacturing location of the supplied product(s) and the distance from the project site.
d. Indication of location (city, state) of the extraction, harvest or recovery location of the raw materials used to manufacture the supplied product(s) and the distance from the project site.
2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section, indicate the Volatile Organic Compound (VOC) content in grams/liter and whether the product meets the requirements of the California Department of Health Services (CDHS) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers, including 2004 Addenda.
3. Provided cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

H. Submittals shall include the following information:

1. Descriptive and product data necessary to verify compliance with Contract Documents.
2. Manufacturer's specifications including materials of construction, metal gauge, thickness and finish.
3. Certified dimensional drawings including clearances required for maintenance or access.
4. Performance data, ratings, operating characteristics, and operating limits.
5. Electrical ratings and characteristics.
6. Wiring and control diagrams, where applicable.
7. Certifications requested, including UL label or listing.
8. List of accessories, which are required but are not being provided by the product manufacturer or are not being furnished under this Section. Identify the Section(s) under which the accessories are being furnished.

I. In addition, submittals shall be clearly marked for the following:

1. Specification Section and Paragraph, or Drawing Schedule/Note/Detail/etc., where equipment is specified.
2. Equipment or fixture identification corresponding to that used in Contract Documents.
3. Accessories and special or non-standard features and materials which are being furnished.

1.23 INTENT

A. It is the intent of the Contract Documents to require finished work, tested and ready for operation.

B. It is not intended that Contract Documents show every pipe, fitting and appurtenance; however, such parts as may be necessary to complete the systems in accordance with best trade practice and Code requirements and to Architect's satisfaction shall be deemed to be included.

C. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. DO NOT SCALE THE DRAWINGS.

1.24 PRODUCT SELECTION

A. Contractor's options for selecting products are limited by Contract Document requirements and governing regulations and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are not necessarily limited to, following various methods of specifying:

1. Single Product Manufacturer Named: Provide product indicated. Advise Architect, and obtain instructions before proceeding, when named product is known to be unacceptable or not feasible.
2. Two or More Manufacturers' Products Named: Provide one of the named products, at Contractor's option, but excluding products which do not comply with requirements. Do not provide, nor offer to provide, an unnamed product unless named products do not comply with requirements or are not feasible.
3. "Acceptable Equivalent" or "Or Equal": Where named products are accompanied by this term or words of similar effect, provide named products or propose substitute product according to paragraph 1.25, SUBSTITUTIONS.
4. Standards, Codes and Regulations: Where specification requires only compliance with a standard, code or regulation, Contractor may select any product which complies with requirements of that standard, code or regulation.
5. Performance Requirements: Provide products which comply with specific performances indicated and which are recommended by manufacturer (in published product literature or by individual certification) for application intended. Overall performance of product is implied where product is specified with only certain specific performance requirements.
6. Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements using specified materials and

components, and complying with specified requirements for fabricating, finishing, testing and other manufacturing processes.

7. Visual Matching: Where matching with an established material is required, Architect's judgment of whether proposed product matches established material shall be final. Where product specified does NOT match established material, propose substitute product according to paragraph 1.25, SUBSTITUTIONS. Follow requirements for CHANGE ORDERS, also, if matching product within cost category of specified product is not available.
8. "Color as Selected by Architect": Unless otherwise noted, where specified product requirements include "Color as Selected by Architect" or words of similar effect, the selection of manufacturer and basic product complying with Contract Documents is Contractor's option and subsequent selection of color is Architect's option.

B. Inclusion by name, of more than one manufacturer or fabricator, does not necessarily imply acceptability of standard products of those named. All manufacturers, named or proposed, shall conform, with modification as necessary, to criteria established by contract documents for performance, efficiency, materials and special accessories.

1.25 SUBSTITUTIONS

A. Contractor shall pay Architect/Engineer for time spent reviewing substitution requests. Charges shall be $120/hour. Submittal of substitution request will be construed as evidence of Contractor's agreement to pay such charges, with no added cost to Owner.

B. Contractor's request for substitution may be submitted only after award of Contract. Requests shall be in writing on Contractor's letterhead and shall include:

1. Contractor's detailed comparison of significant qualities between specified item and proposed substitution.
2. Statement of effect on construction time, coordination with other affected work, and cost information or proposal.
3. Contractor's statement to the effect that proposed substitution will result in overall work equal to, or better than, work originally intended.

C. Substitution requests will be considered: If extensive revisions to Contract Documents are not required; if changes are in keeping with general intent of Contract Documents; if submitted in timely and proper manner, fully documented; and if one or more of following conditions is satisfied; all as judged by Architect:

1. Where request is directly related to "acceptable equivalent" clause, "or equal" clause or words of similar effect in Contract Documents.
2. Where specified product, material or method cannot be provided within Contract Time; but not as a result of Contractor's failure to pursue the work promptly or to coordinate various activities properly.
3. Where specified product, material or method cannot be provided in manner which is compatible with other materials of the work and where Contractor certifies that proposed substitution is compatible.

4. Where specified product, material or method cannot be properly coordinated with other materials of the work and where Contractor certifies that proposed substitution can be properly coordinated.
5. Where specified product, material or method cannot be warranted as required and where Contractor certifies that proposed substitution can be so warranted.
6. Where specified product, material or method cannot be used without adversely affecting Owner's insurance coverage on completed work and where Contractor certifies that proposed substitution can be so used.
7. Where specified product, material or method will encounter other substantial non-compliance, which are not possible to otherwise overcome except by using proposed substitution.
8. Where specified product, material or method cannot receive required approval by governing authority and proposed substitution can be so approved.
9. Where substantial advantage is offered to the Owner; in terms of cost, time, energy conservation or other valuable considerations; after deducting offsetting responsibilities that Owner may be required to bear, including additional compensation to Architect for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.

D. The burden is upon the Contractor, supplier and manufacturer to satisfy Architect that:

1. Proposed substitute is equal to, or superior to, the item specified.
2. Intent of the Contract Documents, including required performance, capacity, efficiency, quality, durability, safety, function, appearance, space clearances and delivery date, will be equaled or bettered.

E. Submission of shop drawings of unspecified manufacturer or shop drawings at variance with the Contract Documents is not a proper request for substitution.

F. Changes in work of other trades, such as structural supports, which are required as a result of substitution and the associated costs for such changes, shall be the complete responsibility of Contractor proposing substitution. Except as noted in subparagraph 1.25.C.9 above, there shall be no additional expense to the Owner.

1.26 SAMPLES

A. Submit samples as requested by Architect.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. Products shall be undamaged and unused at time of installation and shall be complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use.

B. Where available, products shall be standard products of types which have been produced and use previously and successfully on other projects and in similar applications.

C. Where products by their nature and their use are likely to need replacement parts on future date, for maintenance and repair or replacement work, products shall be standard domestically produced products likely to have such parts available to Owner in future.

D. Labels and stamps which are required for observation after installation shall be located on accessible surfaces which, in occupied spaces, are not conspicuous. Other labels and stamps shall be located on concealed surfaces.

PART 3 - EXECUTION

3.1 COOPERATION AND WORK PROGRESS

A. The HVAC work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The HVAC Subcontractor shall cooperate with the Architect, General Contractor, all other Subcontractors and equipment suppliers working at the site. The HVAC Subcontractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The HVAC Subcontractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the HVAC Subcontractor, shall be assumed by him without any additional cost to the Owner.

C. The HVAC Subcontractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.

D. The HVAC Subcontractor shall provide all materials, equipment and workmanship to provide for adequate protection of all HVAC equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The HVAC Subcontractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The HVAC Subcontractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The HVAC Subcontractor shall be responsible for unloading all HVAC equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the General Contractor for hoisting/crane requirements. During construction of the building, the HVAC Subcontractor shall provide additional protection against moisture, dust accumulation and physical damage of the main service and distribution equipment. This shall include furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.

G. It shall be the responsibility of the HVAC Subcontractor to coordinate the delivery of the HVAC equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.

H. The HVAC Subcontractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.

I. Prior to installation, the HVAC Subcontractor has the responsibility to coordinate the exact mounting arrangement and location of HVAC equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the HVAC Subcontractor shall immediately notify the Contractor and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect.

J. The HVAC Subcontractor shall obtain from the Plumbing and Electrical Subcontractors copies of all shop drawing prints showing the ductwork and piping installation as they will be put in place on the project. These drawings shall be thoroughly checked by the HVAC Subcontractor and coordinated with the work of other trades so as to prevent any installation conflict.

3.2 INSTALLATION

A. General:

1. Unless specifically noted or indicated otherwise, all equipment and material specified in Division 23 of this specification or indicated on the drawings shall be installed under this Contract whether or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes or material and equipment.
2. The HVAC Subcontractor shall obtain detailed information from manufacturers of equipment as to proper methods of installation.
3. The HVAC Subcontractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.
4. The HVAC Subcontractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.
5. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or cadmium plated finish or of another approved rust-inhibiting coating.
6. Throughout this Section where reference is made to steel channel supports, it shall be understood to mean that the minimum size shall be 1 5/8" mild strip steel with minimum wall thickness of 0.105", similar to Unistrut P1000 or equal products manufactured by Kindorf or Husky Products Co.

3.3 MATERIALS AND WORKMANSHIP

A. All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NEMA, UL, IPCEA, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL listed and labeled.

B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.

C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.

D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.

E. All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

F. The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

3.4 CLEANING

A. This Section of the specifications shall include the cleaning of all equipment on a day-to-day basis and final cleaning of all HVAC equipment prior to turning building over to the Owner. All necessary cleaning referred to herein shall be cleaned to the satisfaction of the Architect.

3.5 FINAL INSPECTION

A. When all HVAC work on the project has been completed and is ready for final inspection, such an inspection shall be made. At this time, and in addition to all other requirements in the Contract Documents, the HVAC Subcontractor, for the work under this Contract, shall demonstrate that the requirements of these specifications have been met to the Architect's satisfaction.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC 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. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 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.

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. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

C. 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.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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 (3.2 mm) 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 (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) 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 (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

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 inches (38 mm) high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum
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 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230553 - IDENTIFICATION FOR HVAC 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. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 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.

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. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

C. 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.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) 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 (3.2 mm) 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 (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) 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 (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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.

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 inches (38 mm) high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum
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 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:

    a. Constant-volume air systems.
2. Testing, Adjusting, and Balancing Equipment:

    a. Motors.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

    a. The Contract Documents examination report.

b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 ACTION SUBMITTALS

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist 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. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. 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.

1.7 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.8 FIELD 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.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

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 installed systems for manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and 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 equipment performance data including fan 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.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. 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 the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
b. Piping is complete with terminals installed.
c. Water treatment is complete.
d. Systems are flushed, filled, and air purged.
e. Strainers are pulled and cleaned.
f. Control valves are functioning per the sequence of operation.
g. Shutoff and balance valves have been verified to be 100 percent open.
h. Pumps are started and proper rotation is verified.
i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.

j. Variable-frequency controllers' startup is complete and safeties are verified.
k. Suitable access to balancing devices and equipment is provided.

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" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

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 Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping 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. Cross-check 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 Section 233113 "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. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report artificial loading of filters at the time static pressures are measured.

3. 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.
4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. 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 occurs. 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.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

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. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

3.7 TOLERANCES

A. Set HVAC system's airflow rates within the following tolerances:

1. Exhaust Fan: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.8 PROGRESS 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.

3.9 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 engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

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 specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's 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. 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).

E. 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 airflow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).

j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

F. 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. Airflow rate in cfm (L/s).
b. Air velocity in fpm (m/s).
c. Preliminary airflow rate as needed in cfm (L/s).
d. Preliminary velocity as needed in fpm (m/s).
e. Final airflow rate in cfm (L/s).
f. Final velocity in fpm (m/s).
g. Space temperature in deg F (deg C).

G. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.10 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.

B. Construction Manager 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.

C. 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."

D. 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.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall 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 specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. 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 230593

SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: 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" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, 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 2-1, "Rectangular Duct/Transverse 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. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," 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."

D. 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 4, "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."

2.2 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: G60 (Z180) G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. 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.

E. 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 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. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches (76 mm) 4 inches (102 mm) 6 inches (152 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant 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. 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 (2500 Pa), 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.

D. 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. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant 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."
11. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. 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.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant 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."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) 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.

2.4 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 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "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.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

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 "Air 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 "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 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, Exhaust Ducts: Seal Class C.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "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.

3.4 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 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. Paint materials and application requirements are specified in Division 09 painting Sections.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg (250 Pa).

b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "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 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "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) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.

B. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

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 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 233300 - AIR DUCT ACCESSORIES

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. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Flexible connectors.
5. Flexible ducts.
6. Duct accessory hardware.

1.3 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.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials 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 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. 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: G60 (Z180) G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. 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).

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McGill AirFlow LLC.
    b. METALAIRE, Inc.
    c. Nailor Industries Inc.
    d. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized -steel, 0.064 inch (1.62 mm) thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McGill AirFlow LLC.
    b. METALAIRE, Inc.
    c. Nailor Industries Inc.
    d. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:

    a. Multiple or single blade.

b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.

6. Blade Axles: Galvanized steel.
7. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Aluminum.

C. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGill AirFlow LLC.
b. METALAIRE, Inc.
c. Nailor Industries Inc.
d. Ruskin Company.

2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Hat shaped.
b. Galvanized -steel channels, 0.064 inch (1.62 mm) thick.
c. Mitered and welded corners.
d. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized, roll-formed steel, 0.064 inch (1.62 mm) thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Blade Seals: Felt.
9. Jamb Seals: Cambered stainless steel.

10. Tie Bars and Brackets: Galvanized steel.
11. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.3 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. 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.

2.4 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall.

F. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.5 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
5. .

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) 5-3/4 inches (146 mm) wide attached to 2 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. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor 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.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.6 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).

C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.7 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 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. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

H. Install flexible connectors to connect ducts to equipment.

I. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

J. Connect flexible ducts to metal ducts with adhesive.

K. Install duct test holes where required for testing and balancing purposes.

L. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

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 233300

SECTION 233423 - HVAC POWER VENTILATORS

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. In-line centrifugal fans.
2. Centrifugal wall ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: 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.

C. Delegated-Design Submittal: For unit hangars and 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. 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.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

D. Coordination Drawings: Reflected ceiling plans 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. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

E. Field quality-control reports.

F. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

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.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. American Coolair Corporation.
3. Ammerman; Millennium Equipment.
4. Breidert Air Products.
5. Carnes Company.
6. FloAire.
7. Greenheck Fan Corporation.
8. Hartzell Fan Incorporated.
9. JencoFan.
10. Loren Cook Company.
11. Madison Manufacturing.
12. PennBarry.
13. Quietaire Inc.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:

1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.2 CENTRIFUGAL WALL VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Manufacturing Corp.
2. Aerovent; a division of Twin City Fan Companies, Ltd.
3. American Coolair Corporation.
4. Ammerman.
5. Breidert Air Products.

6. Broan-NuTone LLC.
7. Carnes Company.
8. Greenheck Fan Corporation.
9. Hartzell Fan Incorporated.
10. JencoFan.
11. Loren Cook Company.
12. PennBarry.
13. W.W. Grainger, Inc.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
3. Wall Grille: Ring type for flush mounting.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. 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.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators having a static deflection of 1 inch (25 mm)

C. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Section "Roof Accessories" for installation of roof curbs.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators 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 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

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. Fixed face grilles.
2. Linear bar grilles.

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION 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. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

1.4 INFORMATIONAL SUBMITTALS

A. 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.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES

A. Fixed Face Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. A-J Manufacturing Co., Inc.
   b. Anemostat Products; a Mestek company.
   c. Carnes Company.
   d. Dayus Register & Grille Inc.
   e. Hart & Cooley Inc.
   f. Kees, Inc.
   g. Krueger.
   h. Nailor Industries Inc.
   i. Price Industries.
   j. Shoemaker Mfg. Co.
   k. Titus.
   l. Tuttle & Bailey.

2. Material: Aluminum.

3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Perforated core.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches (32 mm) wide.
7. Mounting: Countersunk screw.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Install diffusers, registers, and grilles with airtight connections 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.

END OF SECTION 233713

SECTION 238239 - UNIT HEATERS

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. Cabinet unit heaters with centrifugal fans and electric-resistance heating coils.
2. Propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Details of anchorages and attachments to structure and to supported equipment.
4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
5. Location and arrangement of piping valves and specialties.
6. Location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which unit heaters will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Sprinklers.
    c. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

D. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

E. Samples for Verification: Finish colors for each type of cabinet unit heater and wall and ceiling heaters indicated with factory-applied color finishes.

F. Manufacturer Seismic Qualification Certification: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. 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.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 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. Cabinet Unit Heater Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Qmark.
2. McQuay International.
3. Trane.

B. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

C. Comply with UL 2021.

D. Comply with UL 823.

E. Cabinet: Removable panels for maintenance access to controls.

F. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.

G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

H. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

I. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch (4 mm). Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F (288 deg C) at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

J. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

K. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Type: Permanently lubricated, explosion proof multispeed variable speed.

L. Control Devices:

1. Wall-mounting,fan-speed switch.
2. Wall-mounting thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."

B. Install cabinet unit heaters to comply with NFPA 90A.

C. Install propeller unit heaters level and plumb.

D. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

E. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

F. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

D. Comply with safety requirements in UL 1995.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of 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.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238239

SECTION 260100 – ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 1, General Requirements, shall be included in, and made part of, this Section.

1.2 DESCRIPTION OF WORK

A. Carefully examine all of the Contract Documents, criteria sheets and all other Sections of the specifications for requirements, which affect work under this Section, whether or not such work is specifically mentioned in this Section.

B. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation, of all systems as indicated on the drawings and specified herein.

C. The specifications and drawings describe the minimum requirements that must be met by the Electrical Subcontractor for the installation of all work as shown on the drawings and as specified herein under.

D. Coordinate work with that of all other Trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

1.3 RELATED WORK

A. For work to be included as part of this Section, to be furnished and installed by the Electrical Subcontractor, refer to the following Sections:

1. Section 260519 – Low Voltage Electrical Power Conductors and Cables
2. Section 260526 – Grounding and Bonding for Electrical Systems
3. Section 260529 – Hangers and Supports for Electrical Systems
4. Section 260533 – Raceways and Boxes for Electrical Systems
5. Section 260544 – Sleeve and Sleeve Seals for Electrical Raceways and Cabling
6. Section 260553 – Identification for Electrical Systems
7. Section 262416 – Panelboards
8. Section 262726 – Wiring Devices
9. Section 265100 – Interior Lighting

B. For work related to, and to be coordinated with the electrical work, but not included in this Section and required to be performed under other designated Sections, see the following:

1. Division 1 Section “Temporary Utilities” for temporary building services.
2. Division 1 Section “Scaffolding, Rigging and Hoisting”.
3. Division 1 Section “Cutting and Patching” for electrical construction.
4. Division 2 Section “Excavation, Backfilling and Grading” for building services.
5. Division 2 Section “Utility Services, but not including site lighting” for building services.
6. Division 3 Section “Cast-in Place Concrete” concrete pads for equipment.
7. Division 4 Section “Masonry Work” for electrical construction.
8. Division 7 Section “Firestopping”.
9. Division 7 Section “Caulking, Flashing, Waterproofing, Roofing and setting of Roof Drains”.
10. Division 8 Section “Access Panels”.
11. Division 9 Section “Painting”.

1.4 REFERENCES

A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards and Utility Company Regulations, latest editions.

B. In case of difference between Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations and the Contract Documents, the Electrical Subcontractor shall promptly notify the Architect in writing of any such difference.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the Electrical Subcontractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect/Owner.

E. Applicable Codes and Standards shall include all State Laws, Local Ordinances, Utility Company Regulations, and the applicable requirements of the latest adopted edition of the following Codes and Standards, without limiting the number, as follows:

1. NFPA 13: Sprinkler Systems
2. NFPA 70: National Electrical Code
3. NFPA 72: National Fire Alarm Code
4. NFPA 101: Life Safety Code
5. Occupational Safety and Health Standards
6. Environmental Protection Agency
7. National Fire Protection Association
8. Department of Environmental Protection
9. International Building Code (IBC with CT Supplements)
10. Connecticut Fire Safety Code

F. In these specifications, references made to the following Industry Standards and Code Bodies are intended to indicate the latest volume or publication of the Standard. All equipment, materials and details of installation shall comply with the requirements and latest revisions of the following Bodies, as applicable:

1.	ANSI:	American National Standards Institute
2.	ASTM:	American Society of Testing Materials
3.	AWG:	American Wire Gauge
4.	FM:	Factory Mutual
5.	IEEE:	Institute of Electrical and Electronics Engineers
6.	IES:	Illuminating Engineering Society
7.	NEMA:	National Electrical Manufacturers Association
8.	UL:	Underwriters' Laboratories
9.	IRI:	Industrial Risk Insurers
10.	ISO:	Insurance Services Office
11.	NBS:	National Bureau of Standards
12.	NSC:	National Safety Council

G. Electrical Subcontractor for the work in his scope of work shall give all necessary notices, obtain all permits, pay all governmental taxes, fees and other costs in connection with his work; file for necessary approvals with the jurisdiction under which the work is to be performed. Electrical Subcontractor shall obtain all required Certificates of Inspection for his respective work and deliver same to the Architect before request for acceptance of his portion of work is made and before final payment.

1.5 QUALITY ASSURANCE

A. The manufacturers listed within these specifications have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified.

B. Electrical Subcontractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner.

C. Where equipment of a substitute manufacturer differ from that specified and require different arrangement or connections from those shown, it shall be the responsibility of the Subcontractor responsible for the substitution to modify the installation of the equipment/system to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Electrical Subcontractor shall submit drawings showing the proposed, substitute installation. If the proposed installation is accepted, the Electrical Subcontractor shall make all necessary changes in all affected related work provided under his and other Sections including location of roughing-in connections by other Trades, conduit, supports, etc. All changes shall be made at no increase in the Contract amount or additional cost to the Owner. The General Contractor shall be responsible to assure that the Subcontractor responsible for the substitution bears the cost arising to all other Trades as a result of the substitution.

D. Unless specifically indicated otherwise, all equipment and materials required for installation under these specifications shall be new, unused and without blemish or defect. Equipment and

materials shall be products which will meet with the acceptance of the Authorities having jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed and/or labeled by FM or UL or another testing laboratory, the products shall be so listed and/or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.

1.6 WARRANTY

A. Attention is directed to provisions of the General Requirements and Supplementary General Requirements regarding and warranties for work under this Contract.

B. All warranties shall begin on the Date of Substantial Completion of the entire project or the Owner's acceptance of the workmanship and/or material covered by the warranty, whichever is later. The warranty coverage shall continue for the specified period. Refer to individual specification sections for warranty period. If no specific warranty period is specified, the warranty shall extend for a minimum of 365 days.

C. Manufacturers shall provide their standard warranties for work under the Electrical Trades. However, such warranties shall be in addition to, and not in lieu of, all other liabilities which the manufacturer and Electrical Subcontractor may have by law or by other provisions of the Contract Documents.

D. All materials, items of equipment and workmanship furnished under the Electrical Section shall carry the standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Electrical Subcontractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.

E. The Electrical Subcontractor shall warranty that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

F. Upon receipt of notice from the Owner or Architect of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by the Electrical Subcontractor for his work or any other work affected by the failure(s).

G. Electrical Subcontractor shall furnish, before the final payment is made, a written warranty covering the above requirements in accordance with the General Requirements.

1.7 DEFINITIONS

A. Words in the singular shall also mean and include the plural, wherever the context so indicates, and words in the plural shall mean the singular, wherever the context so indicates.

B. Wherever the terms "shown on drawings" are used in the specifications, they shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

C. Wherever the term "provide" is used in the specifications it will mean "furnish" and "install", "connect", "apply", "erect", "construct", or similar terms, unless otherwise indicated in the specifications.

D. “Work”: Labor, materials, equipment, apparatus, controls and accessories required for proper and complete installation.

E. “Concealed”: Embedded in masonry or other construction; or installed in furred spaces, trenches or crawl spaces; or installed within double partitions or hung ceilings; or in enclosures.

F. “Exposed”: Visible to building occupants, excluding mechanical room and utility tunnel locations.

G. “Acceptable equivalent” or “Equal”: Of weight, size, design, capacity and efficiency to meet requirements specified and shown, and of acceptable manufacturer, as determined in the opinion of the Architect.

H. “Acceptable”: Acceptable, as determined in the opinion of the Architect.

I. “Contractor”: General Contractor.

J. “Named” Product: Manufacturer’s name for product, as recorded in published documents of latest issue as of date of Contract Documents. Obtain Architect’s permission before using products of later or earlier model.

K. Wherever the term "material" is used in the specifications it will mean any "product", "equipment", "device", "assembly", or "item" required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.

L. The terms "approved", or "approval" shall mean the written approval of the Architect.

M. The term "Contract Documents" shall mean the entire set of Drawings and Specifications as listed in the Table of Contents of the General Conditions including all bound and unbound material and all items officially issued to date such as addenda, bulletins, job modifications, etc.

N. The term "specification" shall mean all information contained in the bound or unbound volume, including all "Contract Documents" defined therein, except for the drawings.

O. The terms "directed", "required", "permitted", "ordered", "designated", "prescribed", and similar words shall mean the direction, requirement, permission, order, designation or prescription of the Architect; the terms "approved", "acceptable", "satisfactory", and similar words shall mean approved by, acceptable or satisfactory to the Architect; and, the terms "necessary", "reasonable", "proper", "correct", and similar words shall mean necessary, reasonable, proper or correct in the judgment of the Architect.

P. "Accessible" indicates ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, etc. to gain access. "Accessible ceiling" indicates acoustic tile type hung ceilings. Concealed spline or sheetrock ceilings with access panels shall not be considered accessible ceilings.

Q. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction or in crawl spaces.

R. "Exposed" means not installed underground or "concealed" as defined above.

S. "Electrical Subcontractor" refers to the Subcontractor responsible for furnishing and installation of all work indicated on the Electrical drawings and in the Electrical specifications.

T. "Architect" shall refer to the Architect “TLB Architecture, LLC” and/or the Engineer "Innovative Engineering Services, LLC.”

U. "Owner" shall refer to the Owner or his designated representative.

V. "Other Work Contractor" (O.W.C.) refers to the Contractor(s), or Subcontractor(s) performing work under other Sections of the Contract Documents.

1.8 THE SUBCONTRACTOR

A. The Electrical Subcontractor shall visit the site of the proposed new facility and base his bids from his own site examinations and estimates. The Electrical Subcontractor shall not hold the Architect, Engineer, Owner or their agents or employees responsible for, or bound by, any schedule, estimate or of any plan thereof. The Electrical Subcontractor shall study the Contract Documents included under this Contract to determine exactly the extent of work provided under this Contract, as well as to ascertain the difficulty to be encountered in performing the work, in installing new equipment and systems and coordinating the work with the other Trades and existing building conditions.

B. The Electrical Subcontractor shall faithfully execute his work according to the terms and conditions of the Contract and specifications, and shall take all responsibility for and bear all losses resulting to him in the execution of his work.

C. The Electrical Subcontractor shall be responsible for the location and performance of work provided under his Contract as indicated on the Contract Documents. All parties employed directly or indirectly by the Electrical Subcontractor shall perform their work according to all the conditions as set forth in these specifications.

D. The Electrical Subcontractor shall furnish all materials and do all work in accordance with these specifications, and any supplementary documents provided by the Architect. The work shall include everything shown on the drawings and/or required by the specifications as interpreted by the Architect, regardless of where such information is indicated in the Contract Documents (Architectural, HVAC, Plumbing, Fire Protection, etc.). Unless specifically indicated otherwise, all work and materials furnished and installed shall be new, unused and of the best quality and workmanship. The Electrical Subcontractor shall cooperate with the Architect so that no error or discrepancy in the Contract Documents shall cause defective materials to be used or poor workmanship to be performed.

1.9 COORDINATION OF WORK

A. The Electrical Subcontractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the electrical work.

B. Coordinate work with that of all other Trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

C. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Electrical Subcontractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of the Electrical Subcontractor or that of any other trade caused by the Electrical Subcontractor's neglect, shall be made by him at his own expense, to the Architect's satisfaction.

D. The Electrical Subcontractor must include in his bid sufficient dollar amounts to coordinate the work of this Contract. This project is complex and will require additional time to coordinate all Trades and allow implementation of the Owners Standards and maintenance serviceability requirements. This requirement shall include, but not be limited to, producing the coordination drawings, as many times and as many drawings as required, to ensure serviceability of equipment, as approved by the Architect.

E. Locations of conduits, boxes distribution equipment, systems, etc. shall be adjusted to accommodate the work with interferences anticipated and encountered. The Electrical Subcontractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system component. Accurate measurements and coordination drawings shall be completed to verify dimensions and characteristics of the various systems installations.

F. Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam piping shall normally have the right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.

G. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. The Electrical Subcontractor shall provide elbows, conduit bends, "LB" fittings, offsets in busway, etc. as required for his work to affect these offsets, transitions and changes in direction.

H. All work shall be installed in a way to permit removal (without damage to other parts) of pull and junction box covers, wiring, lighting fixtures, and all other system components provided under this Contract requiring periodic replacement or maintenance. All pull and junction boxes shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles. All work shall be done to allow easy access for maintaining equipment. The Owner and Engineer will require proof via the preparation of large scale sections and part plans that pull and junction boxes, etc. are accessible after the work is completed. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect.

I. The Contract Drawings are diagrammatic only intending to show general runs and locations of conduits, distribution equipment, lighting fixtures, systems equipment, etc. and not necessarily showing all required offsets, details and accessories and equipment to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and

workmanlike installation which will afford maximum accessibility for operation, maintenance and headroom.

J. Where discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches, etc., exist, such conflicts shall be reported to the Architect during bidding and prior to signing of the Contract. If such action is not taken, the Electrical Subcontractor shall furnish such items as part of his work as necessary, for complete and operable systems and equipment, as determined by the Architect.

K. Where drawing details, plans, specification requirements and/or scheduled equipment capacities are in conflict and where feeders, branch circuits or equipment are shown to be different between plans and/or between plans and riser diagrams, details or specifications, the most stringent requirement will be included in the Contract. Electrical systems and equipment called for in the specification and/or shown on the drawings shall be provided under this Contract as if it were required by both the drawings and specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.

L. Final location of all lighting fixtures, smoke detectors, exit signs, switches, receptacles, fire alarm devices, etc., shall be coordinated with the Architectural reflected ceiling plans, architectural elevations, and/or other Architectural details, as applicable and shall not be scaled from locations indicated on the electrical drawings. Obtain approval of locations of all devices from Architect in the field. The Owner/Architect reserves the right to relocate any receptacle, device, lighting fixture, etc. 10'-0" in any direction prior to installation at no additional cost to the Project.

M. Any equipment shown on the Electrical and/or Architectural drawings to be provided with services, shall be included under this Contract as applicable, including all conduit and wiring connections to systems, to make equipment complete and operable. Additional wiring, equipment, etc., shall be provided to accomplish the above requirement, as required, all as part of this Contract, at no extra cost to the Owner. This requirement necessitates that the Electrical Subcontractor review the Architectural drawings and the drawings of other Trades during bidding to ascertain the extent of all requirements, and interface between the Trades and scope of work.

N. The Electrical Subcontractor shall coordinate his work with other Trades' work so that all equipment and systems can be easily, safety and properly serviced and maintained. It is imperative that service personnel can safely access all equipment. Provide safety rails, steps, ladders, valve chains, handle extensions, etc. as required, in addition to the ones shown on the drawings, to ensure safe and easy access to all equipment is provided in a manner approved by the Architect.

O. The HVAC, ATC and Electrical Contractors Scope of Work shall be implemented in accordance with the following matrix:

Device	Furnished	Installed By	Power Wiring	Control Interlock	Fire Alarm Wiring
Control Panels	ATC	ATC	Electric	ATC	N/A
Sheet Metal Dampers	HVAC	HVAC	N/A	ATC	N/A

Device	Furnished	Installed By	Power Wiring	Control Interlock	Fire Alarm Wiring
Sheet Metal Actuators	ATC	ATC	N/A	ATC	N/A
Energy Meters	ATC	HVAC	Electric	ATC	N/A
Control Valves	ATC	HVAC	ATC	ATC	N/A
Variable Speed Drives	HVAC	HVAC	Electric	ATC	N/A

Notes:

1. "Electric" refers to the Electrical Subcontractor/Division 26; "HVAC" refers to the HVAC Contractor/Division 23; "ATC" refers to the ATC Subcontractor who shall be a Subcontractor to the HVAC Contractor.
2. The Electrical Contractor shall provide 120 volt power to junction boxes per floor. All 120 volt power and all low voltage wiring from the junction boxes to control panels and devices shall be provided by the ATC Subcontractor.

1.10 GIVING INFORMATION

A. Electrical Subcontractor shall keep himself fully informed as to the shape, size and position of all openings required for his apparatus and shall give information to the General Contractor and other Subcontractors sufficiently in advance of the work so that all openings may be built in advance.

1.11 EQUIPMENT AND MATERIALS

A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, but readily accessible for inspection by the Architect until installed. All items subject to moisture damage such as controls shall be stored in dry, heated spaces. Equipment such as switchgear with heater elements installed shall have the heater elements energized after the equipment is received by the Electrical Subcontractor.

B. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned and polished thoroughly and turned over to the Owner in a condition satisfactory to the Architect. Damage or defects that develop before acceptance of the work shall be made good at the Electrical Subcontractor's expense.

C. The Electrical Subcontractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.

D. Manufacturer's directions shall be followed completely in the delivery, storage, protection and installation. Promptly notify the Architect in writing of any conflict between any requirements of the Contract Documents and the manufacturer's directions. Obtain the Architect's written instructions before proceeding with the work. Should Electrical Subcontractor perform any work that does not comply with the manufacturer's directions or written instructions from the Architect, he shall bear all costs arising in correcting any deficiencies that should arise.

E. All equipment of one type (such as distribution equipment, cable, wiring devices, fire alarm system, etc.) shall be the products of one manufacturer.

F. Equipment pre-purchased by the General Contractor on behalf of the Owner or by the Owner himself, if assigned to the Electrical Subcontractor, shall be received, installed, tested, etc., as if the equipment was purchased by the Electrical Subcontractor. All guarantees, service contracts, etc., shall be the same as for all other equipment provided under this Contract.

1.12 USE OF PREMISES

A. The Electrical Subcontractor shall confine all apparatus, storage of materials and construction to the limits as directed by the Architect and he shall not encumber the premises with his materials. The Electrical Subcontractor shall be held responsible for repairs, patching, or cleaning arising from any unauthorized use of premises.

B. Notwithstanding any approvals or instructions which must be obtained by the Electrical Subcontractor from the Architect in connection with the use of the premises, the responsibility for the safe working conditions at the site shall remain that of the Electrical Subcontractor. The Architect, Engineer or Owner shall not be deemed to have any responsibility or liability in connection with safe working conditions at the site.

1.13 PROTECTION

A. Materials, conduit, lighting fixtures, switchgear, etc., shall be properly protected during construction and all conduit openings shall be temporarily closed so as to prevent obstruction and damage. Post notice prohibiting the use of all systems provided under the Electrical Contract, prior to completion of work and acceptance of all systems by the Owner except as otherwise, instructed by Architect. Take precautions to protect all materials furnished from damage and theft.

B. The Electrical Subcontractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or electrical systems provided under his Contract.

1.14 DAMAGE TO OTHER WORK

A. The Electrical Subcontractor shall be held responsible and shall pay for all damages caused by his work to the building structures, equipment, conduits, systems, etc., and all work and finishes installed under this Contract. Repair of such damage shall be done by the General Contractor at the expense of the Electrical Subcontractor, to the Architect's satisfaction.

1.15 CORRECTION OF WORK

A. The Electrical Subcontractor shall promptly correct all work provided under his Contract and rejected by the Architect as defective or as failing to conform to the Contract Documents, whether observed before or after completion of work, and whether or not fabricated, installed or completed.

1.16 EXTRA WORK

A. No claim for extra work will be allowed unless it is authorized by the Architect before commencement of the extra said work.

1.17 TOUCH-UP PAINTING

A. All equipment and systems shall be thoroughly cleaned of rust, splatters and other foreign matter of discoloration leaving every part of all systems in an acceptable prime condition. The Electrical Subcontractor for the work under his Contract shall refinish and restore to the original condition all equipment which have sustained damage to the manufacturer's prime and finish coats of paint and/or enamel during the course of construction, regardless of the source of damage.

1.18 PARTS LIST AND INSTRUCTIONS FOR OPERATION AND MAINTENANCE

A. The Electrical Subcontractor shall thoroughly instruct the Owner, to the complete satisfaction of the Architect, in the proper operation of all systems and equipment provided by him. The Electrical Subcontractor shall make arrangements, via the Architect, as to whom the instructions are to be given in the operation of the basic and auxiliary systems and the period of time in which they are to be given. The Architect shall be completely satisfied that the Owner has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Electrical Subcontractor to the Owner's representative, then the Electrical Subcontractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this specification has been complied with.

B. Electrical Subcontractor shall submit to the Architect for approval, the required typed sets (see General Conditions and Division 1) bound neatly in loose-leaf binders, of all instructions for the installation, operation, emergency operation, start-up, care and maintenance of all equipment and systems (including instructions for the ordering and stocking of spare parts for all equipment installed under this Contract). The lists shall include part numbers and suggested supplier. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.

C. Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub-index for each section shall also be provided. The methodology of setting-up the manuals shall be submitted to the Architect and Owner for review prior to final submission of manuals.

D. The instructions shall contain information deemed necessary by the Architect and include but not limited to the following:

1. Introduction:

    a. Explanation of Manual and its use.
    b. Summary description of each Electrical system.
    c. Purpose of each system.

2. System:

   a. Detailed description of each system.
   b. Illustrations, schematics, block diagrams, catalog cuts, and other exhibits.

3. Operations:

   a. Complete detailed, walk-through, with step-by-step, sequential description of all phases of operation for all portions of the systems, including start-up, shutdown, testing and adjusting. Include all posted instruction charts.

4. Maintenance:

   a. Parts list and part numbers.
   b. Maintenance, and replacement charts and Electrical Subcontractor's recommendations for preventive maintenance.
   c. Troubleshooting charts for systems and components.
   d. Instructions for testing each type of part.
   e. Recommended list of on-hand spare parts.
   f. General or miscellaneous maintenance notes.
   g. Provide an estimate of man-hours and material costs to perform scheduled preventative maintenance.

5. Manufacturer's Literature:

   a. Complete listing for all parts with names, addresses and telephone numbers.
   b. Care and operation.
   c. All and only pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
   d. Internal wiring diagrams and engineering data sheets for all items and/or equipment to be furnished.
   e. Guarantee and warranty data.

1.19 MANUFACTURER'S REPRESENTATIVE

A. The Electrical Subcontractor shall provide, at the appropriate time or as directed by Architect, the on-site services of a competent factory trained Engineer of the manufacturer of specific equipment, such as the distribution equipment, generator, fire alarm system, dimming system, nurse call system etc., to inspect, test, adjust and place in proper operating condition any and all items of the same manufacturer. No additional compensation will be allowed for such services. A written report shall be issued by the particular manufacturer with his findings for the Architect's record.

1.20 COORDINATION DRAWINGS

A. The Electrical Subcontractor shall indicate all electrical equipment and conduit provided by him or his Sub-subcontractors on the coordination drawings. This equipment and conduit shall include, but not be limited to, the following:

1. All electrical distribution equipment, drawn to scale with clearance requirements. (Switchboards and panelboards, etc.)
2. All switchboard and panelboard feeder conduits.
3. All conduits for all systems over 2-1/2" in diameter.
4. Conduit routing and rack locations for all conduits regardless of conduit size when more than 4 conduits are grouped in a rack.
5. All pull and splice boxes over 8" in any direction.
6. MC cable routing and rack locations for all MC cable when more than 4 runs are grouped in a rack.
7. Lighting fixture housings and supports that interfere with other system and furnishings.

B. All costs associated with all aspects of coordination drawings, regardless as to how long they take to produce and how many times they have to be redrawn, shall be borne by the Electrical Subcontractor.

1.21 RECORD DRAWINGS/AS-BUILT DRAWINGS

A. The Electrical Subcontractor shall maintain current at the site a set of his drawings on which he shall accurately show the actual installation of all work provided under his Contract indicating hereon any variation from the Contract Drawings, in accordance with the General Conditions and Division 1. Changes, whether resulting from formal change orders or other instructions issued by the Architect, shall be recorded. Include changes in sizes, location, and dimensions of conduit, switchgear, lighting fixtures, fire alarm equipment, wiring devices, etc.

B. The Electrical Subcontractor shall indicate progress by coloring-in various conduits, equipment and associated appurtenances exactly as they are erected. This process shall incorporate both the changes noted above and all other deviations from the original drawings whether resulting from job conditions encountered or from any other causes.

C. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed. They shall be inspected periodically by the Architect and Owner and they shall be corrected immediately if found either inaccurate or incomplete. This procedure is mandatory.

D. At the completion of the job, these prints shall be submitted to the General Contractor and then to the Architect for final review and comment. The prints will be returned with appropriate comments and recommendations. These corrected prints, together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of As-built Record Drawings.

E. The Subcontractor shall be responsible for generating as-built Record Drawings utilizing CAD based documents in AutoCAD Release 2000 DWG or DXF format. A bound set of plans, as well as the computer files, on disk, shall be turned over to the Architect for review. After acceptance of the as-built documents by the Architect, the Electrical Subcontractor shall make any corrections necessary to the as-built documents and prepare one reproducible set of drawings as well as bound blueprint set(s) (quantity as determined by the Architect) for distribution to the Owner via the Architect.

F. The Electrical Subcontractor may use the computer drawing files used for coordination drawings or purchase the Engineers most recently updated computer drawing files at a nominal

charge of $500.00 per drawing file. The updated drawings may not include all changes made during the course of construction and it shall be the Electrical Subcontractors responsibility to update the as-built documents to include all changes brought forth to the project resulting from bulletins, request for information (RFI's), change orders, etc. The Electrical Subcontractor may review the Engineers latest computer files for completeness prior to purchase, however the Engineer will not be responsible for updating the computer files.

G. Included with the above shall be a complete drawing list and a standard layering system, which shall be required to be maintained within the as-built Record CAD documents.

H. The Subcontractor shall be issued bulletins in the same manner as the original Design Documents described above.

I. The as-built CAD documents required shall be in addition to other requirements stated elsewhere.

1.22 SUBMITTALS

A. Prepare and submit shop drawings in accordance with the requirements hereinbefore specified, and with Division 1 Section “Submittal Procedures” in the manner described therein, modified as noted hereinafter.

B. The selection and intention to use a product specified by name shall not excuse the need for timely submission of shop drawings for that product.

C. Prior to submitting shop drawings, submit for review preliminary list of intended or proposed manufacturers for all items for which shop drawings are required.

D. Submission of shop drawings of an unnamed manufacture or shop drawings at variance with the Contract Documents is not a proper request for substitution.

E. Upon completion of shop drawing review, shop drawings will be returned, marked with one of following notations: No Exception Taken, Approved as Noted, Revise and Resubmit, or Rejected. Only products whose shop drawings are marked “No Exception Taken ” or “Approved as Noted” shall be used on the project.

F. Submittals shall include the following information:

1. Descriptive and product data necessary to verify compliance with Contract Documents.
2. Manufacturer’s specifications including materials of construction, metal gauge, thickness and finish.
3. Certified dimensional drawings including clearances required for maintenance or access.
4. Performance data, ratings, operating characteristics, and operating limits.
5. Electrical ratings and characteristics.
6. Wiring and control diagrams, where applicable.
7. Certifications requested, including UL label or listing.
8. List of accessories, which are required but are not being provided by the product manufacturer or are not being furnished under this Section. Identify the Section(s) under which the accessories are being furnished.

G. In addition, submittals shall be clearly marked for the following:

1. Specification Section and Paragraph, or Drawing Schedule/Note/Detail/etc., where equipment is specified.
2. Equipment or fixture identification corresponding to that used in Contract Documents.
3. Accessories and special or non-standard features and materials which are being furnished.

1.23 INTENT

A. It is the intent of the Contract Documents to require finished work, tested and ready for operation.

B. It is not intended that Contract Documents show every pipe, wire, conduit, fitting and appurtenance; however, such parts as may be necessary to complete the systems in accordance with best trade practice and Code requirements and to Architect's satisfaction shall be deemed to be included.

C. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. DO NOT SCALE THE DRAWINGS.

1.24 PRODUCT SELECTION

A. Contractor's options for selecting products are limited by Contract Document requirements and governing regulations and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but are not necessarily limited to, following various methods of specifying:

1. Single Product Manufacturer Named: Provide product indicated. Advise Architect, and obtain instructions before proceeding, when named product is known to be unacceptable or not feasible.
2. Two or More Manufacturers' Products Named: Provide one of the named products, at Contractor's option, but excluding products which do not comply with requirements. Do not provide, nor offer to provide, an unnamed product unless named products do not comply with requirements or are not feasible.
3. "Acceptable Equivalent" or "Or Equal": Where named products are accompanied by this term or words of similar effect, provide named products or propose substitute product according to paragraph 1.25, SUBSTITUTIONS.
4. Standards, Codes and Regulations: Where specification requires only compliance with a standard, code or regulation, Contractor may select any product which complies with requirements of that standard, code or regulation.
5. Performance Requirements: Provide products which comply with specific performances indicated and which are recommended by manufacturer (in published product literature or by individual certification) for application intended. Overall performance of product is implied where product is specified with only certain specific performance requirements.
6. "Color as Selected by Architect": Unless otherwise noted, where specified product requirements include "Color as Selected by Architect" or words of similar effect, the selection of manufacturer and basic product complying with Contract Documents is Contractor's option and subsequent selection of color is Architect's option.

B. Inclusion by name, of more than one manufacturer or fabricator, does not necessarily imply acceptability of standard products of those named. All manufacturers, named or proposed, shall conform, with modification as necessary, to criteria established by contract documents for performance, efficiency, materials and special accessories.

1.25 SUBSTITUTIONS

A. Contractor shall pay Architect/Engineer for time spent reviewing substitution requests. Charges shall be $100/hour. Submittal of substitution request will be construed as evidence of Contractor's agreement to pay such charges, with no added cost to Owner.

B. Contractor's request for substitution may be submitted only after award of Contract. Requests shall be in writing on Contractor's letterhead and shall include:

1. Contractor's detailed comparison of significant qualities between specified item and proposed substitution.
2. Statement of effect on construction time, coordination with other affected work, and cost information or proposal.
3. Contractor's statement to the effect that proposed substitution will result in overall work equal to, or better than, work originally intended.

C. Substitution requests will be considered: If extensive revisions to Contract Documents are not required; if changes are in keeping with general intent of Contract Documents; if submitted in timely and proper manner, fully documented; and if one or more of following conditions is satisfied; all as judged by Architect:

1. Where request is directly related to "acceptable equivalent" clause, "or equal" clause or words of similar effect in Contract Documents.
2. Where specified product, material or method cannot be provided within Contract Time; but not as a result of Contractor's failure to pursue the work promptly or to coordinate various activities properly.
3. Where specified product, material or method can not be provided in manner which is compatible with other materials of the work and where Contractor certifies that proposed substitution is compatible.
4. Where specified product, material or method can not be properly coordinated with other materials of the work and where Contractor certifies that proposed substitution can be properly coordinated.
5. Where specified product, material or method cannot be warranted as required and where Contractor certifies that proposed substitution can be so warranted.
6. Where specified product, material or method can not be used without adversely affecting Owner's insurance coverage on completed work and where Contractor certifies that proposed substitution can be so used.
7. Where specified product, material or method will encounter other substantial non-compliance, which are not possible to otherwise overcome except by using proposed substitution.
8. Where specified product, material or method cannot receive required approval by governing authority and proposed substitution can be so approved.
9. Where substantial advantage is offered to the Owner; in terms of cost, time, energy conservation or other valuable considerations; after deducting offsetting responsibilities

that Owner may be required to bear, including additional compensation to Architect for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.

D. The burden is upon the Contractor, supplier and manufacturer to satisfy Architect that:

1. Proposed substitute is equal to, or superior to, the item specified.
2. Intent of the Contract Documents, including required performance, capacity, efficiency, quality, durability, safety, function, appearance, space clearances and delivery date, will be equaled or bettered.

E. Submission of shop drawings of unspecified manufacturer or shop drawings at variance with the Contract Documents is not a proper request for substitution.

F. Changes in work of other trades, such as structural supports, which are required as a result of substitution and the associated costs for such changes shall be the complete responsibility of Contractor proposing substitution. Except as noted in subparagraph 1.25.C.9 above, there shall be no additional expense to the Owner.

1.26 EQUIPMENT AND BRANCH CIRCUITING DESIGN CRITERIA

A. General Lighting:

1. Switch control shall be provided for each room, and multiple switch controls (minimum 2 switches) for rooms over 500 sq. ft., whether indicated on the drawings or not.
2. All dimmer switches shall be rated per the wiring device section of these specifications.
3. Exit signs shall be circuited to un-switched circuit.
4. Emergency egress lighting shall be provided throughout the building to illuminate all egress corridors, stairwells, lobbies, etc. Branch circuits shall originate from the life safety panel and shall be constant "on" with no toggle switch control. Areas requiring switch control of egress lighting shall be provided with bypass relays mounted as an integral part of the lighting fixture. Emergency branch circuit conductors shall be run in separate dedicated conduits, with no other wiring.

B. Receptacle Branch Circuit Criteria:

1. Convenience receptacles for general use, such as Office Areas, Lounges, Lobbies, etc., will have a maximum of seven (10) duplex receptacles per 20 ampere, single-pole circuit.
2. All duplex and special purpose receptacles indicated for specific equipment will be on a dedicated circuit.

C. Motors:

1. All motors 1/8 HP and under shall be maximum wired three (3) per 20 ampere, single-pole circuit, 120 volt.
2. All motors above 1/8 HP shall be served from an individual branch circuit.
3. Refer to HVAC and Plumbing drawings for location and ratings of motors.
4. All motors 1 HP and above shall be 208 volt, 3 phase and be on individual circuits.
5. All motors 60 HP and above shall have reduced voltage, autotransformer type starters.

6. Selected motors shall have variable frequency drive (VFD) units furnished by the HVAC Contractor. The Electrical Contractor shall coordinate with the HVAC Contractor and provide a disconnecting means and overcurrent device sized to serve each VFD unit.

D. Telephone/Data Outlets:

1. Telephone/data outlets shall be provided in each office, conference room, etc.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

A. Products shall be undamaged and unused at time of installation and shall be complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use.

B. Where available, products shall be standard products of types which have been produced and use previously and successfully on other projects and in similar applications.

C. Where products by their nature and their use are likely to need replacement parts on future date, for maintenance and repair or replacement work, products shall be standard domestically produced products likely to have such parts available to Owner in future.

D. Labels and stamps which are required for observation after installation shall be located on accessible surfaces which, in occupied spaces, are not conspicuous. Other labels and stamps shall be located on concealed surfaces.

PART 3 - EXECUTION

3.1 COOPERATION AND WORK PROGRESS

A. The Electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Electrical Subcontractor shall cooperate with the Architect, General Contractor, all other Subcontractors and equipment suppliers working at the site. The Electrical Subcontractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

B. The Electrical Subcontractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Electrical Sub-contractor, shall be assumed by him without any additional cost to the Owner.

C. The Electrical Subcontractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.

D. The Electrical Subcontractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Electrical Subcontractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Electrical Subcontractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.

F. The Electrical Subcontractor shall be responsible for unloading all electrical equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the General Contractor for hoisting/crane requirements. During construction of the building, the Electrical Subcontractor shall provide additional protection against moisture, dust accumulation and physical damage of the main service and distribution equipment. This shall include furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.

G. It shall be the responsibility of the Electrical Subcontractor to coordinate the delivery of the electrical equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.

H. The Electrical Subcontractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.

I. Prior to installation, the Electrical Subcontractor has the responsibility to coordinate the exact mounting arrangement and location of electrical equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Electrical Subcontractor shall immediately notify the Contractor and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect.

J. The Electrical Subcontractor shall not allow any equipment or piping foreign to the electrical installation to be installed or pass through any room in which electrical systems or equipment are located, such as electric rooms, electric closets, telephone or data closets. The Electrical Subcontractor shall notify the Contractor of such violations and request immediate removal.

K. The Electrical Subcontractor shall obtain from the Plumbing and HVAC Subcontractors copies of all shop drawing prints showing the ductwork and piping installation as they will be put in place on the project. These drawings shall be thoroughly checked by the Electrical Subcontractor and the routing of all conduits and installation of all outlets and electrical

equipment shall be coordinated with the ductwork and piping so as to prevent any installation conflict. Such coordination shall be done prior to roughing in conduits, outlets and electrical equipment.

L. Location of all wall outlets shall be verified with the Architect prior to roughing in conduits. Refer to details and wall elevations on the Architectural drawings. Mounting heights indicated on these drawings and/or specific dimensional information given to the Electrical Subcontractor by the Architect shall take precedence over such information indicated on the Electrical drawings.

M. Refer to all other drawings associated with this project. Any and all equipment which require an electrical supply circuit, switch, controls or connections, whether indicated on the Electrical drawings or not, shall be furnished and installed as directed by the Architect. Locations of lighting fixtures shall conform to the Architectural reflected ceiling plans.

N. Refer to the Architectural drawings for areas in which the concrete slab is poured on grade. In these areas a waterproofing membrane will be installed on the grade fill or earth prior to pouring of slab. Electrical conduits shall be installed to avoid the necessity of penetrating this waterproofing membrane. Penetration of the membrane, if required, shall only be made when specifically allowed by the Architect, and shall be made only at locations directed by the Architect.

3.2 INSTALLATION

A. General:

1. Unless specifically noted or indicated otherwise, all equipment and material specified in Division 16 of this specification or indicated on the drawings shall be installed under this Contract whether or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes or material and equipment.
2. The Electrical Subcontractor shall obtain detailed information from manufacturers of equipment as to proper methods of installation.
3. The Electrical Subcontractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.
4. The Electrical Subcontractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.
5. The Electrical Subcontractor shall coordinate the electric service installation with the local Electric Utility Co., Telephone Company, the City Building Department and the City Fire Department.
6. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or cadmium plated finish or of another approved rust-inhibiting coating.
7. Throughout this Section where reference is made to steel channel supports, it shall be understood to mean that the minimum size shall be 1 5/8" mild strip steel with minimum wall thickness of 0.105", similar to Unistrut P1000 or equal products manufactured by

Kindorf or Husky Products Co. Where reference to channel supports is made under "Lighting Fixtures" paragraph of this Section, the maximum length of span shall be 10'-0". If longer spans are required, the size and wall thickness of the steel channel support shall be as specifically approved by the Engineer.

3.3 MATERIALS AND WORKMANSHIP

A. All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NEMA, UL, IPCEA, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL listed and labeled.

B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.

C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.

D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.

E. All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

F. The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

3.4 CLEANING

A. This Section of the specifications shall include the cleaning of all equipment on a day-to-day basis and final cleaning of all electrical equipment prior to turning building over to the Owner. All necessary cleaning referred to herein shall be cleaned to the satisfaction of the Architect.

B. Electrical Distribution Equipment:

1. All electrical distribution equipment shall be completely cleaned and dried inside and out prior to initial energizing.
2. Cleaning shall consist of vacuuming all busses, windings, enclosures (inside and out), etc. After vacuuming is complete, all equipment shall be wiped down. If equipment is wet or contains moisture, it shall be thoroughly dried and inspected by the manufacturer's representative before energizing.

C. Raceways and Junction Boxes:

1. All raceways and junction boxes shall be blown out and dried prior to installation of feeder conductors and branch circuit conductors.

D. Low Tension Systems:

1. All cabinets and panels for low tension systems shall be thoroughly cleaned and dried prior to system start-up.

E. Electric, Generator and Telephone Rooms:

1. Upon completion of cleaning electrical equipment as described in Paragraph B. above, but before energizing equipment, the entire room shall be swept clean and material storage and garbage shall be removed from the room. At this time, equipment may be energized.
2. Once equipment and room are cleaned and energized, the area shall remain clean and doors shall remain closed and locked until completion of job. Electric rooms shall not be used to store material after equipment is energized. If rooms and equipment are subject to dust and moisture after energizing equipment, the equipment shall be de-energized and recleaned to the same specifications.

F. Final Cleaning:

1. All lighting fixtures, devices, device plates, etc., shall be cleaned and left in "like new" condition to the satisfaction of the Architect, prior to occupancy.
2. All rubbish and discarded materials shall be disposed of and removed from the site on a day-to-day basis.
3. All equipment, whether part of the Electrical Subcontractor's Contract or not, which must be cleaned due to the Electrical Subcontractor's work, shall be cleaned by the Electrical Subcontractor to the satisfaction of the Architect.

3.5 FINAL INSPECTION

A. When all Electrical work on the project has been completed and is ready for final inspection, such an inspection shall be made. At this time, and in addition to all other requirements in the Contract Documents, the Electrical Subcontractor, for the work under this Contract, shall demonstrate that the requirements of these specifications have been met to the Architect's satisfaction.

END OF SECTION 260100

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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 includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. 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:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. 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:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

C. Class 1 Control Circuits: Type THHN-THWN, in raceway.

D. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. 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.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 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 and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING 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: Grounding systems and equipment.

1.3 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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.2 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

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. 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 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. 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.

C. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 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. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

C. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

3.4 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.5 FIELD QUALITY CONTROL

A. 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.

    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.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. 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 Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS 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. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored 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 malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. 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. 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:

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. 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:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other 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.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. 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 (90 kg).

D. 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 (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Light Steel: Sheet metal screws.
7. 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 by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 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 minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Nonmetal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Nonmetal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.3 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ENT: Comply with NEMA TC 13 and UL 1653.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: Comply with UL 514B.

G. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Solvent cements and adhesive primers 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."

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. 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.

2.3 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers 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 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

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, ferrous alloy Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Nonmetallic Floor Boxes: Nonadjustable, round, rectangular.

1. Listing and Labeling: 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.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep), 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).

J. Gangable boxes are allowed.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open, closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete, fiberglass.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open, closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC Type EPC-40-PVC.
2. Concealed Conduit, Aboveground RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: RNC.
2. Exposed, Not Subject to Severe Physical Damage: RNC identified for such use.

3. Concealed in Ceilings and Interior Walls and Partitions: RNC, Type EPC-40-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: RNC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) or 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. 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.
3. EMT: Use setscrew or compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

C. Arrange stub-ups so curved portions of bends are not visible above finished slab.

D. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

E. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

F. Support conduit within 12 inches (300 mm) of enclosures to which attached.

G. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch (25 mm) 2 inches (50 mm) <Insert dimension> of concrete cover in all directions.

H. Stub-ups to Above Recessed Ceilings:

1. Use RNC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

K. 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 (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

L. Install pull wires in empty raceways. 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. Cap underground raceways designated as spare above grade alongside raceways in use.

M. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

N. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

O. 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 the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

P. Expansion-Joint Fittings:

1. 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).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) 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 degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. 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.

Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

S. 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 the box and cover plate or the supported equipment and box.

T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

U. Locate boxes so that cover or plate will not span different building finishes.

V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

X. Set metal floor boxes level and flush with finished floor surface.

Y. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Field-cut openings for 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.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "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.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
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 Company (The).
    d. Pipeline Seal and Insulator, Inc.
    e. Proco Products, Inc.

3. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:

    a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. 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 annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. 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.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

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.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - 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. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

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.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. 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 vinyl label. Install labels at 10-foot (3-m) maximum intervals.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

D. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Enclosed controllers.
d. Contactors.
e. Monitoring and control equipment.

END OF SECTION 260553

SECTION 262416 - PANELBOARDS

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. Lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Detail enclosure types and details for types other than NEMA 250, Type 1.
2. Detail bus configuration, current, and voltage ratings.
3. Short-circuit current rating of panelboards and overcurrent protective devices.
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Qualification Data: For qualified testing agency.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager, Owner no fewer than ten days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's, Construction Manager's, Owner's written permission.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

6. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Coordinate in field.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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 indicated on Drawings or comparable product 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.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: lugs only.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 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. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads.
d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. 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 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Mount panelboard cabinet plumb and rigid without distortion of box.

C. Install overcurrent protective devices and controllers not already factory installed.

D. Install filler plates in unused spaces.

E. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

F. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard load; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test 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.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

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 includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.
5. Communications outlets.
6. Pendant cord-connector devices.

B. Related Sections include the following:

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

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 NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 8300 (duplex).
b. Hubbell; HBL8310 (single), HBL8300H (duplex).
c. Leviton; 8310 (single), 8300 (duplex).
d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; HGF20.
b. Hubbell; HGF8300.
c. Leviton; 6898-HG.
d. Pass & Seymour; 2091-SHG.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), , 2223 (three way).
b. Hubbell; CS1221 (single pole), CS1223 (three way).
c. Leviton; 1221-2 (single pole), 1223-2 (three way).
d. Pass & Seymour; 20AC1 (single pole), 20AC3 (three way).

2.6 OCCUPANCY SENSORS (DUAL TECHNOLOGY)

A. Wall-Switch Sensors:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:
   a. Watt Stopper (The); DW-100 (or equal).
   b. Cooper.
   c. Hubbell.
   d. Leviton.
   e. Pass & Seymour.
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

2.7 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: satin-finished stainless steel.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.

2.8 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Refer to Architect's drawing and coordinate with Owner, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 265100 - INTERIOR LIGHTING

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. Interior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency exit signs units including battery and charger.

3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

B. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

C. Warranty: Sample of special warranty.

1.5 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.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   d. CCT and CRI for all luminaires.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Lamp Current Crest Factor: 1.7 or less.
5. BF: 0.88 or higher.
6. Power Factor: 0.95 or higher.

7. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature match existing, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature match existing, and average rated life of 20,000 hours unless otherwise indicated.

C. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature match existing, and average rated life of 20,000 hours unless otherwise indicated.

D. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature match existing, average rated life of 10,000 hours at three hours operation per start, unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.7 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.8 LED LUMINAIRE

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. Recessed Fixtures: Comply with NEMA LE 4.

C. CRI of minimum 80. CCT of 3500 K.

D. Rated lamp life of 35,000 hours.

E. Lamps dimmable from 100 percent to 10 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage: 120 V ac or 277 V ac. Refer to Light Fixture Schedule.

1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

H. Housings:

1. Extruded-aluminum housing and heat sink.
2. All finishes by Architect.

2.9 DOWNLIGHT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amerlux.
2. Architectural Lighting Works.
3. Cooper Lighting.
4. Edge Lighting.
5. Edison Price Lighting.
6. Eureka.
7. Focal Point LLC.
8. Gallium Lighting, LLC.
9. GE Lighting Solutions.
10. Juno Lighting Group by Schneider Electric.
11. Lighting Science Group.
12. Lighting Services Inc.
13. Lightolier; a Philips group brand.
14. Lithonia Lighting; Acuity Brands Lighting, Inc.

15. MP Lighting.
16. OSRAM SYLVANIA.
17. Peerless: Acuity Brands Lighting, Inc.
18. Pure Lighting.
19. RAB Lighting.
20. Sea Gull Lighting.
21. Specialty Lighting Industries, Inc.
22. Tech Lighting.

B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Universal mounting bracket.

D. Integral junction box with conduit fittings.

2.10 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. All finishes by Architect.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

D. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.

B. Related Requirements:
1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.
2. Section 312500 “Soil Erosion and Sediment Control”
3. Division 33 for Utility demolition and removal.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and [indicated on Drawings] [indicated according to requirements in Section 015639 "Temporary Tree and Plant Protection."] <Insert requirement>.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
   1. Bleachers located at existing baseball field.

C. Utility Locator Service: Notify Call Before You Dig “811” for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and stockpile in areas approved by Architect.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.5 STOCKPILING ROCK

A. Temporarily stockpile naturally formed rocks that measure more than 16" across in least dimension for selection by the Architect to be used as boulders on site. Boulders not selected for installation on site shall be disposed of as noted below.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.

C. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 36 inches.
2. Do not stockpile rock within protection zones.
3. Stockpile surplus rock to allow later use by the Owner.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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.

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

C. Report on Geotechnical Engineering Investigation for New Pool and Bathhouse at Stanley Park – New Britain, CT dated July 28,2016 and prepared by GNCB Consulting Engineers, P.C., Old Saybrook, CT.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subsurface drainage backfill for walls and trenches.
7. Stone Dust screenings for walks and pavements.

B. Related Requirements:

1. Section 012200 “Unit Prices”
2. Section 013200 "Construction Progress Documentation" for recording preexcavation and earth-moving progress.
3. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
5. Section 312319 "Dewatering" for lowering and disposing of ground water during construction.
6. Section 312333 “Trenching” for trenching of utilities.
7. Section 312500 “Soil Erosion and Sediment Control” for erosion and sediment control measures to be taken before and during construction.
8. Section 312550 “Structural Excavation and Backfill” for earthwork below and surrounding buildings, pool, decks and tanks.

9.
10. Section 315000 “Sheeting and Bracing”
11. Section 321000 “Base Courses”
12. Section 321200 “Flexible Paving”
13. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
14. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Unsatisfactory Material: Volume of unsatisfactory material removed beyond the required limits of excavation, measured in original position, excavated, dewatered, hauled and disposed of off-site and replaced with satisfactory compacted fill material or engineered fill from off-site as directed, and other work necessary and related thereto. Measurement for payment for this item will be the actual volume removed and replaced as measured in-place by the Landscape Architect.

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches beneath bottom of concrete slabs-on-grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Landscape Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Landscape Architect. Unauthorized excavation, as well as remedial work directed by Landscape Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

    a. Personnel and equipment needed to make progress and avoid delays.
    b. Coordination of Work with utility locator service.
    c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
    d. Extent of trenching by hand or with air spade.
    e. Field quality control.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

C. Blasting plan approved by authorities having jurisdiction.

D. Seismic survey report from seismic survey agency.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.8 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:

1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.9 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Call Before You Dig" 811 for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.

D. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.

3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Unsatisfactory Soils: Soil Classification [Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487] [Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145], or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

C. Subbase Material: Conform to Form 817, Section 2.12 Subbase and Articles M.02.02 and M.02.06.

D. Granular Fill: Conform to Form 817, Section 2.13 Granular Fill and Article M.02.01.

E. Compacted Granular Fill: Conform to Form 817, Section 2.14 Compacted Granular Fill and Article M.02.02.

F. Rolled Granular Base: Conform to Form 817, Section 3.02 Rolled Granular Base and Article M.02.03.

G. Processed Aggregate Base: Conform to Section 321100 “Base Courses” for Processed Aggregate Base.

H. Controlled Fill shall be 3/8” Crushed Stone.

I. 3/8” Crushed Stone: Conform to Form 817, Article M.01.01, No. 8 Stone.

J. Stone Dust Screenings: Shall be native blue-gray crushed stone material conforming to Form 817, Article M.01.01., gradation ‘screenings’. Sample to be approved by Landscape Architect.

K. Sand: ASTM C 33/C 33M; fine aggregate.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

    a. Grab Tensile Strength: 247 lbf; ASTM D 4632.
    b. Sewn Seam Strength: 222 lbf; ASTM D 4632.
    c. Tear Strength: 90 lbf; ASTM D 4533.
    d. Puncture Strength: 90 lbf; ASTM D 4833.

3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
4. Permittivity: 0.2 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.

1. Perform blasting without damaging adjacent structures, property, or site improvements.
2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 SUBGRADE INSPECTION

A. Notify Landscape Architect when excavations have reached required subgrade.

B. If Landscape Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Landscape Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Landscape Architect, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Landscape Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Landscape Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.15 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Section 334000 “Storm Drainage Systems”

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698 .

3.17 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Landscape Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Landscape Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Landscape Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes dewatering operations.

B. Related Sections include the following:
   1. Section 311000 - Site Clearing
   2. Section 312000 - Earth Moving
   3. Section 312333 - Trenching
   4. Section 312500 - Soil Erosion and Sediment Control
   5. Section 315000 - Sheeting and Bracing

1.3 REGULATORY REQUIREMENTS

A. Conform to all Federal, state, and local laws, ordinances and permits for the manner in which excavations and trenches are dewatered and water disposed.

B. Ascertain the complete extent of all permits required governing dewatering operations, and be bound by their conditions and provisions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide the equipment and materials necessary to perform dewatering operations in accordance with this Specification.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Dispose of water removed from the trenches or excavations by pumping, bailing, siphoning, well-points, or other means in such a manner so as to avoid interference with business, pedestrian, and vehicular traffic, and to prevent damage to persons or property.

B. Depress groundwater encountered within the limits of excavation to an elevation not less than six (6) inches below the limits of the excavation bottom before laying pipe or starting concrete work, unless otherwise permitted by Engineer. Maintain this groundwater's depressed elevation until concrete and joint material have attained adequate strength.

C. Discharge water removed from the excavated areas through pipes, troughs, gutters, or other artificial means to a point of proper disposal.

D. Filter water removed from trenches and excavations through a sediment removal system, approved by the Engineer, prior to discharging from the Project site.

E. Remove mud, silt, debris, and other accumulations discharged to catch basins, sumps, ditches, or water courses. Leave catch basins, sumps, ditches, or water courses in a condition similar to that which existed prior to construction operations.

F. Employ control measures to minimize siltation and erosion in and adjacent to the area of the Work.

G. Locate dewatering pumps as far as possible from residential structures. House pumps in noise suppression enclosures if used during evening and night hours. Implement additional noise suppression measures to reduce operating noise levels to acceptable levels if the operation noise levels, as determined by the Engineer, are excessive. The acceptable level during the hours from 6 p.m. to 7:30 a.m. shall not exceed an average A-weighted sound pressure level of 60 dBA as measured at fifty (50) feet from the sound source or at the closest exterior wall of the nearest residence, whichever distance is less.

H. Maintain trenches and excavations free of water, snow, ice, and other liquids.

END OF SECTION 312319

SECTION 312333 - TRENCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. This Section includes:
1. Excavation, backfill, and compaction requirements for underground utility installation.
2. Pipe bedding material.

B. Related Sections include the following:
1. Section 012200 - Unit Prices
2. Section 311000 - Site Clearing
3. Section 312000 - Earth Moving
4. Section 312200 - Structural Excavation & Backfill
5. Section 312319 - Dewatering
6. Section 312333 - Trenching
7. Section 312500 - Soil Erosion and Sediment Control
8. Section 315000 - Sheeting and Bracing
9. Section 324416 - Trench Drain and Grate
10. Section 331000 - Exterior Water Distribution System
11. Section 333000 - Exterior Sanitary Sewer System
12. Section 334000 - Storm Drainage Systems

1.3 COMPENSATION

A. Work for this Section is affected by unit prices for earth moving specified in Section 012200 - Unit Prices.

B. Compensation for excavation of unsatisfactory soils beyond the required limits of excavation shall be as specified in Section 012200, Unit Price #1 “Replace Unsatisfactory Soils; per cubic yard”. Compensation includes excavation, dewatering, hauling and disposing of materials off-site, removing pavements, sheeting and bracing, replacing this volume with compacted backfill or fill material and geotextile as directed, and other work necessary and related thereto. Measurement for payment for this item will be the actual volume removed and replaced as measured in-place by the Landscape Architect.

C. Compensation for rock excavation, disposal of these materials, and replacing this volume with compacted backfill or fill material as directed shall be as specified in Section 012200, Unit Price #2 “Rock Excavation and Backfill, per cubic yard”.

1.4 DEFINITIONS

A. Broken or Crushed Stone - A product resulting from the artificial crushing of rocks, boulders, or large cobblestones, substantially all faces of which have resulted from crushing operations. It shall consist of sound, tough, durable stone, reasonably free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, mud, dirt, or other deleterious material.

B. Bank or Crushed Gravel - A product consisting of sound, tough, durable particles of crushed or uncrushed gravel, free from soft, thin elongated or laminated pieces and vegetable or other deleterious material. Crushed gravel shall be the manufactured product resulting from the deliberate mechanical crushing of gravel with at least 50% of the gravel retained on the No. 4 sieve having at least one fractured face.

C. Reclaimed Miscellaneous Aggregate - A product consisting of sound, tough, durable particles of crushed reclaimed waste. It shall be free of soft disintegrated pieces, mud, dirt, glass, or other injurious materials and contain no more than 2% by weight (mass) of asphalt cement.

1.5 REFERENCE STANDARDS

A. ANSI/ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

B. ANSI/ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)

C. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

D. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity

E. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles

F. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

G. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile

H. ASTM D6241 - Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

I. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

J. AASHTO T 90 - Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils

K. AASHTO T 96 - Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

L. AASHTO T 104 - Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

M. AASHTO T 146 - Standard Method of Test for Wet Preparation of Disturbed Soil Samples for Test

N. AASHTO T 180, Method D - 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

1.6 SUBMITTALS

A. Samples - Submit a fifty (50) pound sample of each type of bedding and fill material to the testing laboratory in air-tight containers.

B. Test Reports:
1. Submit sieve analysis test results for the select fill materials and imported common fill performed in accordance with ASTM C136. Test date shall be within 90 days of submittal date.
2. Submit abrasion and soundness test results as specified for the select fill materials and plasticity test results as applicable.

1.7 QUALITY ASSURANCE

A. Test and analyze fill materials in accordance with the Reference Standards.

B. Reclaimed miscellaneous aggregate material from off-site is not permitted for use.

PART 2 - PRODUCTS

2.1 COMMON FILL MATERIALS

A. Subsoil - Comply with Section 312000, 2.1 “General”.

2.2 SELECT BEDDING AND FILL MATERIALS

A. Granular Fill - Comply with Section 312000.

B. 3/8” Crushed Stone - Comply with Section 312000.

C. No. 6 Crushed Stone
1. Material shall consist of broken or crushed stone, bank or crushed gravel, reclaimed miscellaneous aggregate, or a mixture thereof.
2. Gradation shall conform to the following when tested from the supply source and after delivered to the Work site.
3. Square Mesh Sieves Percent Passing by Weight

Square Mesh Sieves	Percent Passing by Weight
1”	100
3/4”	90-10
1/2”	20-55

3/8”	0-15
#4	0-5

Source: Form 817-2016, Article M.01.01 No. 6

D. Pipe Bedding
   1. Material shall consist of broken or crushed stone, bank or crushed gravel, reclaimed miscellaneous aggregate, or a mixture thereof.
   2. Gradation shall conform to the following when tested from the supply source and after delivered to the Work site.
   3. Square Mesh Sieves Percent Passing by Weight

Square Mesh Sieves	Percent Passing by Weight
1-1/2”	100
3/4”	45-80
1/4”	25-60
#10	15-45
#40	5-25
#100	0-10
#200	0-5

Source: Form 817-2016, Article M.02.06 Grading “C”

   4. Plasticity
      a. When the fraction of the dry sample passing the #100 mesh sieve is greater than four (4) percent and equal or less than (8) percent by weight, that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
      b. When the fraction of the dry sample passing the #100 mesh sieve is greater than eight (8) percent by weight, the sample will be washed; and the additional material passing the #100 mesh sieve shall be determined by AASHTO Method T 146, except that the #100 mesh sieve will be substituted for the #40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that passed the #100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
   5. Abrasion - Material shall show less than fifty (50) percent loss on abrasion from the AASHTO T 96 Test.
   6. Soundness - Material shall be tested for soundness as directed by the Engineer. The AASHTO T 104 Test shall show less than fifteen (15) percent loss at the end of five (5) cycles.

E. Sand Bedding - - Free of silt, clay, loam, friable or soluble materials and organic matter, graded in accordance with ASTM C136 within the following limits:

Square Mesh Sieves	Percent Passing by Weight
3/8”	100
#50	30 max
#200	5 max

2.3 GEOTEXTILE

A. Nonwoven Geotextile - Comply with Section 312000.

2.4 WARNING TAPE

A. Warning Tape and Detectable Warning Tape - Comply with Section 312000.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify stockpiled fill to be reused is approved.

B. Verify areas to be backfilled are free of debris, snow, ice, or water, and that the ground surfaces are not frozen.

3.2 PREPARATION

A. Identify required lines, level, contours, and datum.

B. Sawcut pavements to be removed as delineated on the Drawings or as directed by the Engineer. Sawcut paved surfaces in neat and straight joint lines with a device approved by the Engineer. Pavements to be removed may be sawcut in advance but shall not be removed until the Work is ready to be installed.

C. Rough grade to subgrade prior to excavating for piping or structures.

D. Compact subgrade surfaces to density requirements for backfill material.

E. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases. Repair damage caused by construction operations at no additional cost to Owner or owner of damaged structure, utility or pipe chase, as approved by owner of damaged structure, utility or pipe chase.

F. Provide respective utility representatives an opportunity to inspect all uncovered facilities. Coordinate the repair of damaged utilities prior to backfilling.

3.3 EXCAVATION

A. Cut trenches to limits shown on Drawings. Where pipe is to be laid below the ground line, excavate a trench to the required depth and grade the bottom to the elevation of the bottom of the bedding material. Where pipe is to be laid in a fill area, place the embankment and compact to an elevation twelve (12) inches above the top of the proposed pipe, then excavate the trench and install the pipe.

B. Hand trim excavation and leave free of loose matter.

C. Excavate to minimum of one (1) horizontal to one (1) vertical line at existing foundations on rock, or a minimum of two (2) horizontal to one (1) vertical line at existing foundations on soil or decomposed rock, unless otherwise approved by Engineer.

D. Notify Engineer of unexpected subsurface conditions and discontinue work in affected area until notified to resume work. Excavate unstable material, as ordered by Engineer, and replace with a layer of select fill materials as shown on the Drawings, as ordered by the Engineer.

E. Grade excavation top perimeter to prevent surface water run-off into excavation.

F. Correct unauthorized excavation at no cost to Owner.

G. Fill unauthorized over-excavated areas with granular fill or crushed stone as ordered by the Engineer, at no cost to Owner.

H. Remove unsuitable soil as ordered by the Engineer, and backfill as ordered by the Engineer.

3.4 BACKFILLING

A. Backfill trenches to contours and elevations. Use unfrozen materials. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

B. Place and compact select fill materials in continuous layers not exceeding ten (10) inches (loose depth) in open areas, and eight (8) inches (loose depth) in areas where compacted by hand guided vibratory equipment, except as noted. Compact each individual layer uniformly to obtain the required minimum density of not less than 95% of the dry density achieved by the AASHTO T 180, Method D Test.

C. Place and compact common fill material in continuous layers not exceeding twelve (12) inches (loose depth).

D. Employ a placement method so not to disturb or damage foundation dampproofing or utility lines.

E. Maintain optimum moisture content of backfill materials to attain required compaction density.

F. Dispose of surplus backfill materials and unsuitable materials as specified in Section 312000.

G. Leave stockpile areas completely free of excess fill materials.

3.5 GEOTEXTILE

A. Place geotextile and carefully backfill to avoid puncturing or tearing. Provide twelve (12) inch minimum overlap to cover aggregate and between adjoining geotextile sheets.

3.6 TOLERANCES

A. Top Surface of Backfilling - Plus or minus one (1) inch.

3.7 FIELD QUALITY CONTROL

A. Compaction tests on in-place materials, as required in the Schedule of Locations and Backfill Requirements list below, shall be performed in accordance with ATSM D6938.

B. The Owner may employ a laboratory for testing of backfill materials and compaction.

C. Cooperate with and provide access to the Work for the testing laboratory. Such testing does not relieve the Contractor of responsibility for quality control for the Work and delivering the Work in compliance with specification requirements.

D. Should testing of a material fail to meet the specification requirements, resolve the problem as appropriate. Reimburse the Owner for all testing charges incurred by the Owner after the second failure, if repeated failures occur in the same material or the same lift.

3.8 SCHEDULE OF LOCATIONS AND BACKFILL REQUIREMENTS

A. Perform in-place compaction tests on fill materials in accordance ASTM D6938. The paragraphs below identify location, fill material to be used (identified from lower to upper fill type), compacted thickness of each fill, and compaction expressed as a percentage of maximum density and optimum moisture in comparison with ANSI/ASTM D1557.

B. Fill under pavement (including but not necessarily limited to bituminous, concrete, brick, stone or other masonry paved surfaces) or structures, from the top of bedding material or bottom of pipe or culvert: Granular fill to subgrade unless otherwise indicated or directed, compacted to 95%.

C. Fill under vegetated areas, from the top of bedding material: Subsoil fill to subgrade, compacted to 95%, except as noted in Section 329200 and 329300.

D. Firmly compact crushed stone with a minimum of two passes with a vibratory plate compactor.

3.9 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, under-pinning, or other methods required to prevent cave-in or loose soil from falling into excavation and as required by all applicable local, state and Federal safety regulations and codes.

B. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

C. Use proper caution when excavating in and around utility service facilities. Machine excavation shall not come within eighteen (18) inches from the designated location of a utility line except for pavement materials when in a roadway. After locating and verifying the location of the utility line utilizing hand tools, the Contractor may proceed with the careful use of power equipment.

D. Notify utility owner if accidental contact to a known utility or an unknown underground facility is discovered. Protect utility and facilities as directed by utility owner.

END OF SECTION 312333

SECTION 312500 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes:
1. Geotextile silt fence.
2. Haybales.
3. Temporary mulching.
4. Temporary erosion control blankets.
5. Permanent turf reinforcement mats.
6. Sedimentation control at drainage structures.
7. Filter bag for dewatering pump discharge.
8. Construction entrance.
9. Other methods and measures required to control soil erosion and sedimentation on a continuous basis throughout the course of the Work.

B. Related Sections include the following:
1. Section 311000 - Site Clearing
2. Section 312000 - Earth Moving
3. Section 312319 - Dewatering
4. Section 312333 - Trenching
5. Section 329115 - Soil Preparation
6. Section 329200 - Turf and Grasses

1.3 SUBMITTALS

A. Certifications that materials proposed for use meet the requirements of this specification, unless otherwise approved by the Engineer.

1.4 QUALITY ASSURANCE

A. Parts 2 and 3 of this specification and the Contract Drawings set forth the minimum requirements for soil erosion and sediment control and do not include all methods and measures that may be required to control soil erosion and to prevent sediment from entering wetlands, water bodies and watercourses. It is the Contractor's responsibility to employ such additional methods and measures as may be necessary to fully comply with the guidelines and recommendations set forth in the “Connecticut Guidelines for Soil Erosion and Sediment Control”, the Connecticut Council on Soil and Water Conservation, 2002, latest edition.

B. Maintain a copy of the “Connecticut Guidelines for Soil Erosion and Sediment Control” on the Project site for continuous reference thereto.

1.5 REFERENCE STANDARDS

A. ASTM D3776 - Standard Test Methods for Mass Per Unit Area (Weight) of Fabric

B. ASTM D3786 - Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method

C. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

D. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity

E. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles

F. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

G. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile

H. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

I. ASTM D4884 - Standard Test Method for Strength of Sewn or Bonded Seams of Geotextiles

J. ASTM D5141 - Standard Test Method for Determining Filtering Efficiency and Flow Rate of the Filtration Component of a Sediment Retention Device

PART 2 - PRODUCTS

2.1 MATERIALS

A. Geotextile Silt Fence - Pervious sheet of polypropylene, nylon, polyester, ethylene, or similar filaments. The geotextile shall be non-rotting, acid and alkali resistant, and have sufficient strength and permeability for the purpose intended. Filaments in the geotextile shall be resistant to absorption. The filament network must be dimensionally stable and resistant to delamination. The geotextile shall be free of any chemical treatment or coating which will reduce the permeability. The geotextile shall be free of any flaws or defects which will alter its physical properties. Torn or punctured geotextiles shall not be used. The geotextile shall be certified by the manufacturer, or supplier, as conforming to the following requirements:

Property	Test Method	Minimum Average Roll Value
Filtering Efficiency	ASTM D5141	75% (min)
Grab Tensile Strength	ASTM D4632	100 lbs
Puncture Strength	ASTM D4833	50 lbs
Mullen Burst	ASTM D3786	250 psi
UV Resistance @ 500 hrs	ASTM D4355	70%
Apparent Opening Size	ASTM D4751	0.60 - 0.90 mm (max.)
Permittivity	ASTM D4491	0.05 sec^{-1}
Flow Rate	ASTM D4491	0.2 $gal/ft^2/min$

B. Haybales - As shown on Drawings.

C. Temporary Mulching - Hay, salt hay, straw, manufactured cellulose fiber or wood pulp mulch as set forth in the "Connecticut Guidelines for Soil Erosion and Sediment Control" as approved by Engineer.

D. Temporary Erosion Control Blankets - North American Green EroNet DS75.

E. Permanent Turf Reinforcement Mats - North American Green VMax SC250.

F. Sedimentation Control at Drainage Structures - Catch basin insert shall be Siltsack as manufactured by ACF Environmental. Siltsack shall be manufactured to fit the grate dimensions.

Property	Test Method	Minimum Average Roll Value
Grab Tensile Strength	ASTM D4632	315 lbs
Grab Tensile Elongation	ASTM D4632	15%
Puncture Strength	ASTM D4833	140 lbs
Mullen Burst	ASTM D3786	800 psi
Trapezoidal Tear	ASTM D4533	125 x 115 lbs
UV Resistance @ 500 hrs	ASTM D4355	80%
Apparent Opening Size	ASTM D4751	40 Sieve (max.)
Permittivity	ASTM D4491	0.70 sec^{-1}
Flow Rate	ASTM D4491	50 $gal/ft^2/min$

G. Filter Bag for Dewatering Pump Discharge
1. Dirtbag® as manufactured by ACF Environmental. The filter bag shall be manufactured using a polypropylene nonwoven geotextile sewn into a bag with a double needle matching using a high strength thread.
2. The filter bag shall have a spout large enough to accommodate a four (4) inch discharge hose.
3. The discharge hose shall be secured with straps which shall secure the hose and prevent pumped water from escaping without being filtered. The filter bag seams shall conform to the following ASTM test methods:

Property	Test Method	Minimum Average Roll Value
Seam Wide Width Strength	ASTM D4884	100 lbs/in
Weight	ASTM D3776	8 oz/yd2
Grab Tensile Strength	ASTM D4632	205 lbs
Grab Tensile Elongation	ASTM D4632	15%
Puncture Strength	ASTM D4833	110 lbs
Mullen Burst	ASTM D3786	350 psi
Trapezoidal Tear	ASTM D4533	125 x 115 lbs
UV Resistance @ 500 hrs	ASTM D4355	70%
Apparent Opening Size	ASTM D4751	US 80 Sieve
Permittivity	ASTM D4491	1.5 sec^{-1}
Flow Rate	ASTM D4491	100 $gpm/ft^2/min$

A. Construction Entrance - As shown and specified on the Drawings.

B. 3/8" Crushed Stone - Comply with Section 312000.

C. Woven and Non-Woven Geotextile - Comply with Section 312333.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with Stormwater Pollution Control Notes and Details on the Drawings.

B. Dispose of all retained sediment off-site in a legal manner or in a stable upland area as approved by the Engineer.

C. Install, maintain, replace, relocate, and remove specified materials in accordance with the manufacturer's written instructions and details or as shown on Drawings.

END OF SECTION 312500

SECTION 312550 – STRUCTURAL EXCAVATION AND BACKFILL

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. Excavating and backfilling for swimming pools, surge tanks, retaining walls, buildings and pool decks.
2. Drainage course for pool and surge tank mat slabs and pool decks.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for recording pre-excavation and earth-moving progress.
2. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete.
3. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 312000 “Earthmoving” for excavation and backfill not associated with structures and beyond the limits of structural fill and stone drainage layers below structures.
5. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
6. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Structural Backfill: Soil meeting the requirements herein specified and used to backfill structures.

B. Crushed Stone: Stone as meeting the requirements herein specified and used as structural fill and drainage course below concrete mat slabs and pool decks.

C. Structural Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated for the purposes of constructing pools, foundations, retaining walls and pool decks.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

D. Fill: Soil materials used to raise existing grades.

E. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for other excavations, that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping:

1. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

2. Equipment for Other Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.

F. Structures: Buildings, footings, foundations, retaining walls, swimming pools, slabs, tanks, pool decks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

I. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at Project site.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
d. Extent of trenching by hand or with air spade.
e. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Structural Backfill
3. Crushed Stone

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

1. Blasting: Blasting is not allowed.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures as indicated are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials to accommodate operations to the extent indicated. The Contractor may test on-site soils for use as approved backfill materials, but failure to meet specified requirements shall not constitute cause for additional cost to the Owner.

B. Satisfactory Soils:

1. Structural Backfill: Structural fill shall be sandy gravel, or gravely sand, free of organic material, loam, snow, ice, frozen soil, and other objectionable materials and shall be well-graded within the following limits:

U.S. Standard Sieve Size	Percent Finer by Weight
4 inch	100
No. 4	20-80
No. 40	5-50
No. 200	0-10

2. Crushed Stone: Crushed Stone shall be clean, sound stone free of organic material, loam, snow, ice, frozen soil, and other objectionable materials and shall meet the requirements of Connecticut DOT Form 814, Section M.01.01, and as follows:

Square Mesh Size	Percent Passing
1 inch	100
¾ inch	90-100
½ inch	20-50
3/8 inch	0-20
No. 4	0-5

C. Unsatisfactory Soils: Soils not meeting the criteria for Structural Backfill and Crushed Stone shall be unsatisfactory for these categories.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2.2 GEOTEXTILES

A. Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:

a. Grab Tensile Strength: 157 lbf ; ASTM D 4632.
b. Sewn Seam Strength: 142 lbf ; ASTM D 4632.
c. Tear Strength: 56 lbf; ASTM D 4533.
d. Puncture Strength: 56 lbf; ASTM D 4833.

3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
4. Permittivity: 0.2 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to an agreed upon change in Contract Sum. Changes in the Contract Time may be authorized for rock excavation if it is demonstrated that such excavation impacts the overall schedule.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling, ram hammering; or ripping of material not classified as rock excavation is earth excavation.
    b. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Refer to Section 312000 “Earth Moving”.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Refer to Section 312000 “Earth Moving”.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted structural backfill or crushed stone material as directed.

C. Proof-roll subgrade below the swimming pool slabs with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons, or another vehicle acceptable to Architect to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

1. Fill unauthorized excavation as directed by Architect, without additional compensation.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 STRUCTURAL BACKFILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place fill on subgrades free of mud, frost, snow, or ice.

C. Backfill:

1. Place structural fill or crushed stone in maximum loose lifts of 12 inches. Compact to 98% of its maximum dry density, at optimum moisture content, in accordance with ASTM D1557. In restricted areas where only hand-operated equipment can be utilized, maximum loose lift shall be 8 inches.
2. Confirm compaction with Testing Agency prior to continuing with subsequent lifts. If compaction of 98% is not achieved, continue to compact until reaching the specified compaction of 98%.
3. Once achieved, continue with the same lift heights and compaction procedures until required grades are achieved.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place structural backfill and crushed stone, where indicated in layers not more than 9-inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:

1. Under structures, building slabs, pool slabs, retaining wall footings, pool decks and similar structures scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.

3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner may engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Swimming Pool Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property, off site, but within the City of New Britain. Stockpile or spread soil as directed by Owner.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 315000 - SHEETING AND BRACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes furnishing, installing, maintaining, and removing of all sheeting and bracing.

B. Related Sections include the following:
1. Section 311000 - Site Clearing
2. Section 312000 - Earth Moving
3. Section 312319 - Dewatering
4. Section 312333 - Trenching
5. Section 312500 - Soil Erosion and Sediment Control

1.3 SUBMITTALS

A. Certifications - Submit as required under Paragraphs 1.4.D and 1.4.E herein.

B. Delegated Design Submittal
1. Submit computations and substantiating data for sheeting and bracing, upon Engineer’s request.
2. Submit at least thirty (30) calendar days prior to constructing or installing sheeting and bracing.
3. Computations and substantiating data shall be prepared by a civil or structural professional engineer that is both licensed in the state in which the Project is located and responsible for checking and approving the design and construction of the sheeting and bracing. Substantiating data shall include:
    a. An outline plan showing the lines on which it is proposed to drive sheeting;
    b. Bracing methods to support the loads imposed on the sheeting;
    c. Bracing and sheeting material documentation;
    d. Written directions of the order of installation and removal of the sheeting and bracing in relation to excavation, backfill and fill.
4. The submitted computations and substantiating data is for informational purposes only. The Engineer or Owner may comment on the adequacy of such computations, data, or plans. The submittal of computations and substantiation data, and the review comments or lack thereof from the Engineer or Owner, shall not serve to relieve the Contractor's sole responsibility for the safety of the Work, success of the sheeting and bracing, or successful completion of the Work.

C. Pre-Driving Requirements - Submit documents (including but not limited to pre-driving survey, pre-driving photographs and/or video recordings, and existing condition and water quality of

wells) obtained and developed from complying with the Pre-Driving Requirements under Article 3.1 of this Specification.

1.4 QUALITY ASSURANCE

A. Furnish and install tightly sealed sheeting and/or bracing: to comply with the applicable Federal and State Safety Codes and OSHA Regulations; to permit successful dewatering; to accommodate traffic; to permit access to adjacent occupied properties; to protect adjacent buildings, pavements, structures, and all existing utilities; to provide an opening of proper depth and width in which to install the proposed pipes and other underground structures; and to protect workmen, employees of the Owner, Engineer, State, and County, and the public from death or injury from bank failure, earth collapse, or earth movement of any nature whatsoever.

B. Be entirely and solely responsible for the adequacy and sufficiency of supports, sheeting, bracing, shoring, underpinning, cofferdamming, and components facilitating structural stability and safety. Assume responsibility for damages on account of injury to persons or damage to adjacent pavements and public and private property (including but not limited to, the Work under construction, existing buildings, underground pipes, conduits, and structures, and other aboveground and underground facilities) which injury or damage results directly from Contractor's failure to install or to leave in place adequate and sufficient supports, sheeting, bracing, underpinning, cofferdamming, and components facilitating structural stability and safety.

C. Design sheeting and bracing safely, carry to adequate depths, and brace as necessary for proper performance of the Work. Construct to permit the required excavation. Provide interior dimensions to give sufficient clearance for construction of forms and their inspection. Correct movements of sheeting or bracing which prevent the proper completion of substructure. No part of sheeting or bracing shall be allowed to extend into the substructure without written permission of the Engineer.

D. For excavations over five (5) feet deep or when the excavations or the sheeting method is outside the scope of governmental agencies having jurisdiction, certify to the Engineer that the sheeting and bracing design has been checked and approved as adequate and in accordance with existing laws and regulations, by a civil or structural licensed professional engineer, licensed in the state in which the Project is located, experienced in design of sheeting and bracing, and that the sheeting and bracing has been constructed in accordance with the design which was checked and approved by said engineer. A certification for design shall be submitted prior to placing any sheeting and bracing and a certification for construction shall be submitted immediately after sheeting and bracing has been constructed.

E. Where relocation of bracing is required to permit the installation of work by the various trades, such relocation shall be approved by a civil or structural licensed professional engineer, licensed in the state in which the Project is located, responsible for checking and approving the design of the sheeting and bracing prior to such relocation, and certification of such approval shall be submitted to the Engineer.

F. Provide necessary, required decking, guards, fences, planking and the like to maintain safe pedestrian and vehicular traffic. Within public highway rights-of-way, perform work, provide protection in manner approved by governmental agencies having jurisdiction.

G. Do not prune or trim trees to facilitate installation of sheeting and bracing without obtaining written permission from the trees' owner(s). Adjust the sheeting and bracing to avoid damaging the trees when written permission is not obtained from the trees' owner(s). Any adjustments should be reflected in revised computations and substantiating data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. As selected by the Contractor and shall be in conformance with the requirements of the applicable Safety Codes and ASTM Standards.

PART 3 - EXECUTION

3.1 PRE-DRIVING REQUIREMENTS

A. Prior to the commencement of driving or removal of sheet piling, arrange a meeting at the Project site with Engineer and representatives of any interested agencies and utilities with interests related to the method, manner, and procedure of driving and removing of all types of sheet piling, including soldier piles.

B. Locate structures, underground utilities, and properties in the vicinity of the Project site and verify that the driving or removal of sheet piling will not disturb them.

C. Notify all owners of structures and underground utilities, and other persons that own or reside in nearby properties that might be affected of the intention to drive or remove sheet piling, including soldier piles. Notice shall be provided sufficiently in advance to enable the agencies, companies, and persons and the Contractor to take such steps as may be necessary to protect life and property.

D. Conduct pre-driving survey and obtain pre-driving photographs and/or video recordings taken within and adjoining the limits of the Work, including adjacent private residences within five-hundred (500) feet of the proposed driving area, prior to commencing sheet piling driving or removal operations. Document existing conditions including, but not limited to, such items as driveways, walks, curbs, foundation walls, building walls, windows, wells, swimming pools, and other similar items. Provide to the Engineer one annotated set of color digital copies of the images and/or recordings stamped with date and time.

E. Determine the locations of structures and underground utilities, and verify that driving operations will not disturb them. Notify each public utility or others having structures in proximity to the site, and others who may be affected, of intention to use explosives. Give such notice sufficiently in advance to enable the involved agencies/companies/persons and the Contractor to take such steps as may be necessary to protect life and property. Such notice will not in any way relieve the Contractor of responsibility for any damage resulting from his driving operations.

F. Document the existing condition and water quality of wells that may be affected by the driving or removal of sheet piling where owner of such wells permit. Where permission to document is denied, obtain such information as may be available on the wells from the firm that drilled the wells and/or the Local Department of Health, the Connecticut Department of Energy and Environmental Protection, or the Connecticut Well Drilling Board.

3.2 PERFORMANCE

A. Prevent damage to adjacent structures from excessive vibration during driving operations. The maximum allowable peak particle velocity measured by seismograph at the closest structures shall be 2.0 inches per second. Monitor pile driving operations with seismograph equipment placed at nearby structures as directed by the Engineer.

B. Drive sheeting plumb at least twelve (12) inches below the proposed work and to such deeper depths as may be required for safety and protection of the Work. Drive sheeting to the full depth before excavation is started where necessary.

C. Sheeting may be left in-place at the option of the Contractor, to serve the Contractor's own interest; to protect existing facilities, the Work built, or to be built under this Contract; or for the safety of the public, etc., at no cost to the Owner. Sheeting left in place with the approval of the Engineer shall be cut off at an elevation as directed by the Engineer, and the cut-offs removed from the site and disposed of, at no cost to the Owner. It is expressly understood and agreed that removing or leaving in-place the sheeting and bracing shall not relieve the Contractor from any responsibility for any loss or damage whatever due to omission of or failure of said sheeting and bracing.

D. Pull out sheeting if it is to be removed. Do not continuously vibrate sheeting out.

E. Backfill and compact simultaneously with withdrawal of sheeting and as each layer is compacted. Fill and compact voids left by the removed sheeting. Disturbance to and loss of compaction density of the backfill is not permitted. Backfilling shall comply with Section 312000 for excavations and Section 312333 for trenches.

F. Be responsible for and remedy all damages to persons and public and private properties caused by driving and removal of sheeting.

END OF SECTION 315000

SECTION 321100 - BASE COURSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. This Section includes:
   1. Subbase.
   2. Processed aggregate base (also used for surface course of parking lots).

B. Related Sections include the following:
   1. Section 311000 - Site Clearing
   2. Section 312000 - Earth Moving
   3. Section 312333 - Trenching
   4. Section 321200 - Flexible Paving
   5. Section 321313 - Concrete Paving

1.3 DEFINITIONS

A. Broken or Crushed Stone - A product resulting from the artificial crushing of rocks, boulders, or large cobblestones, substantially all faces of which have resulted from crushing operations. It shall consist of sound, tough, durable stone, reasonably free from soft, thin, elongated, laminated, friable, micaceous or disintegrated pieces, mud, dirt, or other deleterious material.

B. Bank or Crushed Gravel - A product consisting of sound, tough, durable particles of crushed or uncrushed gravel, free from soft, thin elongated or laminated pieces and vegetable or other deleterious material. Crushed gravel shall be the manufactured product resulting from the deliberate mechanical crushing of gravel with at least 50% of the gravel retained on the No. 4 sieve having at least one fractured face.

C. Reclaimed Miscellaneous Aggregate - A product consisting of sound, tough, durable particles of crushed reclaimed waste. It shall be free of soft disintegrated pieces, mud, dirt, glass, or other injurious materials and contain no more than 2% by weight (mass) of asphalt cement.

1.4 REFERENCE STANDARDS

A. ANSI/ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

B. AASHTO T 90 - Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils

C. AASHTO T 96 - Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

D. AASHTO T 104 - Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

E. AASHTO T 146 - Standard Method of Test for Wet Preparation of Disturbed Soil Samples for Test.

F. AASHTO T 180, Method D - 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.

1.5 SUBMITTALS

A. Samples - Submit fifty (50) pound sample of each type of base material to the testing laboratory in air-tight containers.

B. Test Reports:
1. Submit sieve analysis test results for the base materials performed in accordance with ASTM C136. Test date shall be within 90 days of submittal date.
2. Submit abrasion and soundness test results as specified for each material and plasticity test results as applicable

1.6 QUALITY ASSURANCE

A. Provide at least one (1) person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly qualified and experienced in the placing of the types of bases specified and who shall direct the Work performed under this Section.

B. Test materials in accordance with the Reference Standards.

C. Reclaimed miscellaneous aggregate material from off-site is not permitted for use.

PART 2 - PRODUCTS

2.1 BASE MATERIALS

A. Subbase
1. Material shall consist of broken or crushed stone, bank or crushed gravel, reclaimed miscellaneous aggregate, or a mixture thereof.
2. Gradation shall conform to the following when tested from the supply source and after delivered to the construction site:

Square Mesh Sieve	Percent Passing by Weight
3-1/2"	100
1-1/2"	55-100
1/4"	25-60
#10	15-45
#40	5-25
#100	0-10
#200	0-5

Source: Form 817-2016, Article M.02.06 Grading "A".

3. Plasticity
   a. When the fraction of the dry sample passing the #100 mesh sieve is greater than four (4) percent and equal or less than (8) percent by weight, that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
   b. When the fraction of the dry sample passing the #100 mesh sieve is greater than eight (8) percent by weight, the sample will be washed; and the additional material passing the #100 mesh sieve shall be determined by AASHTO Method T 146, except that the #100 mesh sieve will be substituted for the #40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that passed the #100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
4. Abrasion - Material shall show less than fifty (50) percent loss on abrasion from the AASHTO T 96 Test.
5. Soundness - Material shall be tested for soundness as directed by the Engineer. The AASHTO T 104 Test shall show less than fifteen (15) percent loss at the end of five (5) cycles for coarse aggregates.

B. Processed Aggregate Base
1. Gradation of coarse and fine aggregates, combined and mixed by Engineer approved methods, shall conform to the following when tested from the supply source and after delivered to construction site:

Square Mesh Sieve	Percent Passing by Weight
1-1/2"	100
1"	90-100
3/4"	75-100
1/4"	30-60
#40	5-25
#100	3-12

Source: Connecticut Department of Transportation, Bureau of Engineering and Highway Operations Reference File No. 163-J, Issued March 4, 1963 and revised through June 26, 2001, Medium Gradation

2. Coarse aggregate
   a. Material shall be gravel, broken stone, or on-site reclaimed miscellaneous aggregate.
   b. The AASHTO T 96 test shall show less than fifty (50) percent loss on abrasion.
   c. The AASHTO T 104 test shall show less than fifteen (15) percent loss on coarse aggregate after five (5) cycles.
3. Fine Aggregate
   a. Material shall be natural sand, stone sand, screenings, or any combination thereof. It shall be limited to material 95% of which passes a #4 sieve having square openings

and not more than 8% of which passes a #200 sieve. The material shall be free from clay, loam, and deleterious materials.

b. Plasticity
   1) When natural sand is used the following applies:
      a) When the fraction of the dry sample passing the #100 mesh sieve is greater than four (4) percent and equal or less than (8) percent by weight, that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
      b) When the fraction of the dry sample passing the #100 mesh sieve is greater than eight (8) percent by weight, the sample will be washed; and the additional material passing the #100 mesh sieve shall be determined by AASHTO Method T 146, except that the #100 mesh sieve will be substituted for the #40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that passed the #100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
   2) When natural sand, screenings, or a combination of screenings and natural sand or combination of stone and natural sand are used the following applies:
      a) When the fraction of the dry sample passing the #100 mesh sieve is six (6) percent and equal or less than ten (10) percent by mass, that fraction shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO Method T 90.
      b) When the fraction of the dry sample passing the #100 mesh sieve is greater than ten (10) percent by weight, the sample shall be washed and additional material passing the #100 mesh sieve shall be substituted for the #40 mesh sieve where the latter is specified in AASHTO Method T 146. The combined materials that have passed the #100 mesh sieve shall not have sufficient plasticity to permit the performing of the plastic limit test using AASHTO T 90.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Subbase
   1. Shape the prepared foundation to the required cross-section and compact thoroughly. Where underdrains and outlets are specified on the Drawings or ordered by the Engineer, they shall be in place and functioning before any subbase material is placed.
   2. Spread Subbase uniformly upon the prepared foundation to such depth that this course will be of the specified depth after final compaction: bases eight (8) inches or less in specified depth may be constructed in one course; bases over eight (8) inches in specified depth shall be constructed in multiple courses with each course depth less than or equal to eight (8) inches.
   3. Compact each individual layer uniformly to obtain the required minimum dry density of not less than 95% of the dry density achieved by the AASHTO T 180, Method D.
   4. If the Subbase contains reclaimed miscellaneous aggregate containing bituminous concrete, the required wet density after compaction on this course shall not be less than 95% of the wet density when tested in accordance with AASHTO T 180, Method D.
   5. Maintain optimum moisture content of each layer to attain required compaction density.

6. Remove and replace Subbase material that has been mixed or churned up with the foundation material. Compact replaced Subbase material to the required minimum density.

B. Processed Aggregate Base
1. Spread aggregate uniformly upon the prepared subbase to such depth that this course will be of the specified depth after final compaction. Each course shall have a depth of not more than four (4) inches after final compaction unless otherwise ordered.
2. Compact with a power roller weighing not less than ten (10) tons or an equivalent vibratory roller or compactor.
3. Apply water while compacting from an approved watering device by a vertical spray delivering a flushing stream.
4. Compact and bind in passes that are parallel with the centerline, begin at the outside or low edges, progressing towards the middle or high edge, and overlap each previous pass.
5. Continue compacting and binding operations until voids in the aggregates are reduced to provide a firm and uniform surface satisfactory to the Engineer.
6. Compact and bind placed Processed Aggregate Base at the end of each day's work when the road is open to traffic.
7. Compact each individual layer uniformly to obtain the required minimum dry density of not less than 95% of the dry density achieved by the AASHTO T 180, Method D.
8. Maintain optimum moisture content of each layer to attain required compaction density.
9. Remove and replace Processed Aggregate Base that has been mixed or churned up with the Subbase material. Compact replaced Processed Aggregate to the required minimum density.
10. For locations where processed aggregate base is the surface course, this specification still applies.

3.2 TOLERANCES

A. Subbase Top Surface - Plus or minus one (1) inch of the grade indicated on the Drawings.

B. Processed Aggregate Base Top Surface - Plus or minus one half (1/2) inch of the grade indicated on the Drawings.

3.3 ADJUST AND CLEAN

A. Correct deficiencies and unmet tolerances in a manner approved by the Engineer.

B. Remedy irregularities on the select fill material surfaces that develop, during or after compaction by loosening the in-place material and removing or adding coarse aggregate as required. Compact, broom, and wet the area of remedy and surrounding areas. Continue to compact until the surface is satisfactorily uniform.

C. Eliminate settlement in a manner approved by the Engineer.

D. Clean base course surfaces of trash and other debris and remove and dispose of off-site in a legal manner.

END OF SECTION 321100

SECTION 321200 - FLEXIBLE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. This Section includes the installation of Hot Mix Asphalt (HMA) paving.

B. Related Sections include the following:
1. Section 311000 - Site Clearing
2. Section 312000 - Earth Moving
3. Section 312333 - Trenching
4. Section 321100 - Base Courses
5. Section 321600 - Curbs

1.3 DEFINITIONS

A. See Section 4.06 - Bituminous Concrete, Article 4.06.01 of the Form 817-2016.

1.4 REFERENCE STANDARDS

A. See Sections 4.06 and M.04 of the Form 817-2016.

B. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods

1.5 SUBMITTALS

A. Comply with Section M.04, Article M.04.01 and Article M.04.03 of the Form 817-2016.

B. Asphalt Certifications - Submit the name, address and telephone number of the asphalt plant proposed for use and a certification that:

C. The mixing plant used to produce the hot mix asphalt has been inspected and approved by the Chief, Materials Section of the Connecticut Department of Transportation and that such approval is current and effective throughout the period when the hot mix asphalt is manufactured for this Project.

D. The hot mix asphalt delivered to the Project site conforms in all respects to the requirements of the Form 817-2016 for the mixture class specified.

1.6 QUALITY ASSURANCE

A. Provide at least one (1) person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly qualified and experienced in the placing of the type of pavements and overlays specified and who shall direct the Work performed under this Section.

B. Use only personnel thoroughly trained and experienced in the skills required for installing and finishing hot mix asphalt pavements and in operating the required equipment.

C. No finish surface pavement shall be started during the period of November 15 of any one year through April 15 the following year, unless otherwise approved by Engineer.

D. Asphalt plants shall be available for inspections and tests by the Engineer.

E. Reclaimed or recycled materials from off-site is not permitted for use.

1.7 DELIVERY, STORAGE AND HANDLING

A. Hauling equipment shall conform to the Form 817-2016. The Contractor is advised that length of haul, manner of haul, temperature of asphalt, and similar criteria, have a direct bearing on the quality and acceptability of the finished pavements. These and all other criteria shall be properly controlled such that the hot mix asphalt when placed, is identical to that specified, approved, and as it left the asphalt plant. Segregation of aggregates, whether occasioned by hauling operations, improper mixing at the asphalt plant, or for other reasons, will result in rejection of the pavement. Clusters and pockets of aggregate in the finished pavement surface, with voids surrounding the aggregates, are unacceptable and will be rejected.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot Mix Asphalt (HMA)
   1. Conform to Section M.04 of the Form 817-2016.
   2. Mixture shall be from one source of supply and originate from one plant unless otherwise authorized by Engineer.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Hot Mix Asphalt (HMA) Pavements:
   1. Conform to Section 4.06, Article 4.06.03 of the Form 817-2016 with the following exceptions:

a. Density testing for placed HMA shall be performed in accordance with ASTM D2950.
b. Bituminous core samples are not required unless otherwise specified by the Engineer.

2. Provide finished paved surfaces that are smooth, even, and free from surface defects and irregularities. Edges shall be straight, and shall meet existing pavements smoothly. Pavement shall present a smooth, continuous, and workmanlike appearance, free from patch work, rough edges, spalling areas, potholes, depressions, bumps, and other defects. The complete finished installation shall meet with the complete approval of the Engineer with respect to appearance as well as structural integrity and other criteria.

3.2 ADJUST AND CLEAN

A. Correct deficiencies and unmet tolerances in a manner approved by the Engineer.

B. Promptly remove areas of irregularities or defects which remain after compaction of the permanent pavement is completed and place sufficient new material to form a true and even surface. Roll all minor surface projections, joints, and minor honeycombed areas to a smooth finish. The final surface shall be of uniform texture conforming to the line, grade, and cross-section shown on the Drawings, existing, or as directed by the Engineer.

C. Eliminate settlement in a manner approved by the Engineer.

D. Clean paved surfaces of dirt, stones, and other debris. Remove and dispose of the discarded mix, trash, and other debris off-site in a legal manner.

END OF SECTION 321200

SECTION 321313 - CONCRETE PAVING

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.

B. Form 817 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. Section Includes Concrete Paving
   1. Reinforced concrete pavements for walkways including joint materials and sealants.
   2. Reinforced concrete pavements with integral curb.
   3. Reinforced concrete lawn seat – Alternate No. 6.
   4. Reinforced flush concrete curb.

B. Related Requirements:
   1. Section 012300 “Alternates” for Lawn Seating and Concrete Walks Alternate No. 6.
   2. Section 033000 "Cast-in-Place Concrete" for general building and pool applications of concrete and for pool decks.
   3. Section 312000 "Earth Moving" for concrete paving base courses.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete paving Subcontractor.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing compounds.
5. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer 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.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Epoxy-Coated Welded-Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

B. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

C. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated, [**plain**] [**deformed**].

D. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 plain-steel bars.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

F. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Conform to the requirements of Form 817, Section M.03.01, Class 'F' and ASTM C-94. Batch mixing at site not acceptable.

1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type II.

B. Normal-Weight Aggregates: ASTM C 33/C 33M,, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260/C 260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

E. Water: Potable and complying with ASTM C 94/C 94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

1. Thickness: ¼ inch or as detailed in the Drawings.
2. Depth: to match concrete section.

B. Joint Sealant: Two component polyurethane elastomeric type complying with FS-TT-S-00227, self-leveling designed for foot traffic, as manufactured by SIKA, Pecora, or approved equal.
1. Color to be selected by Landscape Architect.

C. Sealant Backer Rod: Compressible rod stock or polyethylene foam, polyethylene jacketed, butyl rubber foam, or neoprene foam, as recommended by sealant manufacturer where required for back-up of sealant.

D. Grout: Non-shrink, non-staining grout. Conform to CTDOT Form 816, Article M.03.01-12.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience. Conform to the requirements of Form 816, section M.03.01, Class 'F' and ASTM C-94. Batch mixing at site not acceptable.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 3 inches, plus or minus 1 inch (25 mm).

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction where possible. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Conform to article 921.03-3 of Form 817. Forms shall be true to line, grade, and radius shown. Poorly formed curves will not be accepted.

B. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

C. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

D. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Expansion/Isolation Joints: Form Expansion/isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 20 foot on center unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Tooled/Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand

floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. If evaporation rate in "Evaporation Retarder" Paragraph below is exceeded, ACI 305R states that plastic shrinkage cracking is probable. See manufacturers' literature or ACI 305R for estimated moisture-loss chart that relates relative humidity, air and concrete temperature, and wind velocity to rate of evaporation.

D. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

E. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

F. Retain one or more options in "Curing Methods" Paragraph below. Do not use curing compound on surfaces to be covered by unit pavers, tiles, or other materials set in mortar.

G. Curing Methods: Concrete shall be liquid membrane-forming cured and protected as specified in accordance with Article 4.01.03-F.7(a) of CTDOT Form 816.

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.

3.9 SEALANT INSTALLATION

A. Install joint sealant in all expansion joints in accordance with manufacturer’s installation instructions. Remove dust, dirt and loose material. Clean and prime joints.

B. Apply sealants in continuous beads, without open joints, voids, or air pockets. Hand tool and finish all joints.

C. Confine materials to joint areas with masking tape or other precautions. Insure joint sealing is cleanly executed with no override onto adjacent pavement.

D. Remove excess compound promptly as work progresses and clean adjoining surfaces. Protect until fully cured.

E. In rough surfaces or joints of uneven widths, hold joint sealant well back into joints.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing and inspection: Conform to Section 033000 requirements.

B. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

F. Concrete paving will be considered defective if it does not pass tests and inspections.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

H. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321520 - STONE DUST SURFACING

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.

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. Section includes Construction of stone dust walk and base as indicated on the drawings.

B. Related Requirements:
1. Section 312000 “Earth Moving” for stone dust screenings and processed aggregate base

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Submit Samples and certified sieve analysis of stone dust screenings.

1.4 QUALITY ASSURANCE

A. Material Standards: as defined in ConnDOT Form 817.

PART 2 - PRODUCTS

2.1 Processed Aggregate Base: Conform to ConnDOT Form 817 Section 3.04 and Article M.05.01

2.2 Stone Dust Screenings: Shall be native blue-gray crushed stone material conforming to Form 817, Article M.01.01., gradation ‘screenings’. Sample to be approved by Landscape Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that the base surface is smooth, free of irregularities, depressions, or unsuitable material which cannot be compacted to the required density. Prepare base as required, conforming to Section 312000.

3.2 INSTALLATION

A. Install processed aggregate base true to the line and grade, and to the depth specified in the drawings, and compacted to the required density. Conform to Section 312000.

B. Install Stonedust Screenings to the depth specified in the drawings, on top of processed aggregate base course using light equipment, protecting base course.

3.3 PROTECTION

A. Maintain proper drainage to prevent washouts and flooding of surface. Protect from damage and make repairs.

B. Protect all work until acceptance of the project. Replace or refinish the stone dust surface if damaged prior to acceptance.

C. Clean up debris from installation procedures.

END OF SECTION 321520

SECTION 321600 - CURBS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. This Section includes:
1. Concrete curbing.
2. Bituminous concrete curbing.
3. Precast concrete wheel stops.

B. Related Sections include the following:
1. Section 033000 - Cast-in-Place Concrete
2. Section 312000 - Earth Moving
3. Section 321100 - Base Courses
4. Section 321200 - Flexible Paving

1.3 REFERENCE STANDARDS

A. See Sections 6.01 and M.03 of Form 817-2016 for Concrete for Structures and Portland Cement Concrete.

B. See Section M.08.02-4 of Form 817-2016 for Precast Concrete.

C. See Section M.04 of Form 817-2016 for Bituminous Concrete Materials.

D. AASHTO M 213 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.4 SUBMITTALS

A. Comply with Section 033000 for cast-in-place concrete submittals.

B. Asphalt Certifications - Submit the name, address and telephone number of the asphalt plant proposed for use and a certification that:

C. The mixing plant used to produce the bituminous concrete materials has been inspected and approved by the Chief, Materials Section of the Connecticut Department of Transportation and that such approval is current and effective throughout the period when the bituminous concrete materials are manufactured for this Project.

D. The bituminous concrete materials delivered to the Project site conforms in all respects to the requirements of the Standard Specifications for the mixture class specified.

1.5 QUALITY ASSURANCE

A. Provide at least one (1) person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly qualified and experienced in the placing of the type of bases, pavements and overlays specified and who shall direct all work performed under this Section.

B. Use only personnel thoroughly trained and experienced in the skills required for installing and finishing concrete pavements and curbing, and in operating the required equipment.

C. Provide finished surfaces that are smooth, even, and free from surface defects and irregularities. Edges shall be straight, and shall meet existing pavements smoothly. Pavement shall present a smooth, continuous, and workmanlike appearance, free from patch work, rough edges, spalling areas, potholes, depressions, bumps, and other defects. The complete finished installation shall meet with the complete approval of the Engineer with respect to appearance as well as structural integrity and other criteria.

D. No finish surface pavement shall be started during the period of November 15 of any one year through April 15 the following year, unless otherwise approved by Engineer.

E. All materials and the asphalt and concrete plants shall be available for inspections and tests by the Engineer.

F. Reclaimed or recycled materials from off-site is not permitted for use on this Project.

G. Protect concrete from environmental conditions:
   1. Do not continue or commence concrete operations during rainy weather conditions.
   2. When the ambient air temperatures is 90°F, cool the forms that come in contact with the concrete mix to below 90°F for a minimum of one (1) hour prior to and one (1) hour after the completion of the concrete placement by means of water spray or other methods satisfactory to the Engineer.
   3. When there is a potential for ambient air temperature below 40°F during placement or curing operations, submit a Cold-Weather Concreting Plan to the Engineer.

1.6 DELIVERY STORAGE AND HANDLING

A. Hauling equipment shall conform to the Standard Specifications. The Contractor is advised that length of haul, manner of haul, temperature of asphalt, and similar criteria, have a direct bearing on the quality and acceptability of the finished pavements. These and all other criteria shall be properly controlled such that the job mix of bituminous concrete when placed, is identical to that specified, approved, and as it left the asphalt plant. Segregation of aggregates, whether occasioned by hauling operations, improper mixing at the asphalt plant, or for other reasons, will result in rejection of the pavement. Clusters and pockets of aggregate in the finished pavement surface, with voids surrounding the aggregates, are unacceptable and will be rejected.

PART 2 - PRODUCTS

2.1 CONCRETE CURBING

A. Concrete
   1. Cast-in-place Concrete - Class "F" concrete mix design in accordance with Section M.03 of Form 817-2016.
   2. Precast Concrete
      a. Material shall be in accordance with Section M.08.02-4 of Form 817-2016, except as applied to precast concrete curbing instead of precast concrete drainage structures.
      b. 4,400 psi minimum 28-day compressive strength.
      c. Five (5) to seven (7) percent entrained air, unless approved by Engineer.

B. Expansion joint filler - Preformed expansion joint filler shall be bituminous cellular type and shall conform to the requirements of AASHTO M 213.

2.2 BITUMINOUS CONCRETE CURBING

A. Curb Mix - Conform to Section M.04 - Bituminous Concrete of Form 817-2016.

B. Tack Coat - Conform to Section M.04 - Bituminous Concrete of Form 817-2016.

2.3 PRECAST CONCRETE WHEEL STOP

A. Precast concrete, 4,000 psi minimum 28-day compressive strength. Each stop shall be reinforced with two No. 4 deformed steel reinforcing bars, minimum. Provide chamfered corners and drainage slots on underside and provide holes for dowel-anchoring to substrate.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Concrete Curbing
   1. Excavation
      a. Excavate to the required depths below finished grades to provide the base upon which the curb is set and compacted to a firm and even surface.
   2. Section Lengths
      a. Construct curbing in uniform lengths of approximately ten (10) feet, unless otherwise directed by the Engineer, and arranged such that the joint in the curbing is opposite a joint in the adjoining concrete pavement slab and be similar to it. No sections less than six (6) feet in length are permitted.
   3. Subbase
      a. Place and compact granular fill to depths shown on drawings.
      b. Layers shall not exceed six (6) inches depth prior to compaction.
      c. Wet and roll or tamp each layer after spreading.
   4. Cast-in-Place Curbing
      a. Place on moist base. Do not place on soft, muddy, or frozen base.
      b. Forms

1) Securely stake, brace, and firmly hold forms to the required line and grade.
2) Place forms tightly to prevent mortar leakage.
3) Clean and oil or wet forms immediately before placing concrete against them.
4) Remove mortar from previous placements, debris, and foreign material from forms and prior to commencing concrete placement.
5) Remove ponded water from within forms prior to commencing placement.
6) Construct forms for exposed faces such that they can be removed before concrete has taken final set in order to permit correction of surface irregularities.

c. Concrete Placement
1) Maintain five (5) to seven (7) percent entrained air at time cast-in-place concrete is deposited into forms.
2) Slip form equipment conforming to the Drawings is acceptable for use.
3) Where slip forms and precast is not used, place concrete in forms, strike off with a template, compact by approved methods, and finish to a smooth even surface.

d. Curing and protection
1) Cast-in-place curbing shall be cured and protected in accordance with Section 6.01.03 of Form 817-2016.

5. Precast Concrete Curbing
a. Place a mound of concrete at each joint, as shown on the Drawings.

6. Backfilling
a. After concrete has set sufficiently, backfill and grade to the lines shown on the plans. Place and compact in lifts not exceeding six (6) inches in depth.

B. Bituminous Concrete Curbing
1. Prepare the surface by cleaning it of loose and foreign material and drying it as required.
2. Apply tack coat to surface immediately prior to installing curbing.
3. Upon arrival on-site, transfer mixture from truck to hopper of curbing machine.
4. Keep mixture clean and free from dirt and foreign material.
5. Install compact using mechanical curbing machine.
a. Obtain approval from Engineer for hand laid curbing locations when the use of a mechanical curbing machine is not practical.
b. Obtain a smooth traveling surface for the curbing machine's wheels as necessary.
6. Keep traffic a safe distance from the curbing for at least 24 hours and until the curb has sufficiently set to prevent damage to work.

C. Precast Concrete Wheel Stop
1. Securely attach wheel stops into at-grade pavement with not less than two galvanized steel dowels embedded in holes cast into wheel stops.

3.2 TOLERANCES

A. Curbing - Final surface shall not vary more than plus or minus one quarter (± 1/4) inch in ten (10) feet from the grades and cross slopes shown on the Drawings. The entire surface shall be checked by the Contractor in the presence of the Engineer with an acceptable ten (10) foot straightedge.

3.3 ADJUST AND CLEAN

A. Correct deficiencies and unmet tolerances in a manner approved by the Engineer.

B. Eliminate settlement in a manner approved by the Engineer.

C. Clean all surfaces of dirt, stones and other debris and remove and dispose of off-site all discarded mix, trash, and all other debris.

END OF SECTION 321600

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes waterborne painted pavement markings and hot applied painted pavement markings.

B. Related Sections include the following:
   1. Section 321200 - Flexible Paving

1.3 REFERENCE STANDARDS

A. TT-P-1952F Federal Specification - Paint, Traffic and Airfield Marking, Waterborne, or latest revision date.

B. ASTM D211 - Specifications for Chrome Yellow and Chrome Orange.

C. ASTM D476 - Specifications for Titanium Dioxide Pigments.

D. ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.

E. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.

F. ASTM D869 - Test for 45-deg, 0-deg Directional Reflectance Factor of Opaque Specimens by Broad Band Filter Reflectometry.

G. ASTM D1475 - Standard Test Method For Density of Liquid Coatings, Inks, and Related Products.

H. ASTM D2486 - Standard Test Methods for Scrub Resistance of Wall Paints.

I. AASHTO M 247, Type 1 - Standard Specification for Glass Beads Used in Pavement Markings.

1.4 SUBMITTALS

A. Product Data - Submit manufacturer’s literature and technical data for materials appurtenant within this Specification.

1.5 QUALITY ASSURANCE

A. Provide at least one (1) person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly qualified and experienced in the installing pavement markings.

B. Use truck-mounted painting machine for centerlines, lane lines, and shoulder lines. Use hand striping machine for other pavement marking applications.

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

A. Waterborne Pavement Marking Paint:
1. White in color unless otherwise indicated on the Drawings.
2. Formulated and manufactured from first-grade raw materials and be free from defects and imperfections that might adversely affect the serviceability of the finished product.
3. Materials shall not exhibit settling or jellying after storage in sealed containers that may affect the performance of the product.
4. Provide proper anchorage, refraction, and reflection for the finished glass spheres when applied as specified.
5. Composition shall be at the discretion of the manufacturer provided the finished product meets applicable Federal, State and Local regulations for this product and the following requirements:

Property	Value
Total nonvolatile	≥70% by weight
Pigment	45-55% by weight
Weight per gallon	≥12.5 lbs. (per ASTM D1475)
Drying time to no pick up	≤15 minutes (per ASTM D711)
Lead	≤0.06%
Resin solids composition	100% acrylic emulsion polymer
Volatile organic compounds	≤150 grams/liter (excluding water)
Closed-cup flash point	≥100^{0}F
Viscosity	80-90 Kreb units (per ASTM D562)
Dry opacity contrast ratio	≥0.96
Bleeding ratio	≥0.97 (per FS-TT-P-1952F)
Abrasion Resistance	≥210 liters of sand required to remove paint film (per FS-TT-P-1952F)
Scrub Resistance	≥300 cycles (per ASTM D2486)

6. Capable of being applied at ambient temperatures.
7. Flexible enough to not show cracking or flaking when subjected to TT-P-1952F flexibility test in which the panels used are 3-inch x 5-inch tin plates and 35-31 U.S. Gauge in thickness. The tin panels shall be lightly buffed with steel wool and thoroughly cleaned with solvent before using for tests.

8. Maintain colorfastness for approximately two (2) years and not discolor in sunlight. Color determination shall be made without beads after a minimum of 24 hours.
9. Yellow color shall be a visual match for Federal Specification No. 595-13538. If not a visual match, the diffuse day color shall conform to the following CIE Chromaticity coordinate limits:

	x/y	x/y	x/y	x/y	Brightness
White	0.305 0.295	0.360 0.360	0.388 0.377	0.280 0.310	84.0 min.
Yellow	0.485 0.455	0.506 0.452	0.484 0.428	0.477 0.438	50.0 min.

B. Hot-Applied Waterborne Pavement Marking Paint
1. White in color unless otherwise indicated on the plans.
2. Formulated and manufactured from first-grade raw materials and be free from defects and imperfections that might adversely affect the serviceability of the finished product.
3. Materials shall not exhibit settling or jellying after storage in sealed containers that may affect the performance of the product.
4. Provide proper anchorage, refraction, and reflection for the finished glass spheres when applied as specified.
5. Composition shall be at the discretion of the manufacturer provided the finished product meets applicable Federal, State and Local regulations for this product and the following requirements:

Property	Value
Total nonvolatile	≥76% by weight
Pigment	58-63% by weight
Weight per gallon	≥12.5 lbs (per ASTM D1475)
Drying time to no pick up	≤120 seconds
Lead	≤0.06%
Resin solids composition	100% acrylic emulsion polymer
Volatile organic compounds	≤150 grams/liter (excluding water)
Closed-cup flash point	$\geq 100^0$F
Viscosity	80-90 Kreb units (per ASTM D562)
Dry opacity contrast ratio	≥0.96
Bleeding ratio	≥0.97 (per FS-TT-P-1952F)
Abrasion Resistance	≥210 liters of sand required to remove paint film (per FS-TT-P-1952F)
Scrub Resistance	≥300 cycles (per ASTM D2486)

6. The reflectorized line shall dry to no pick up in 120 seconds or less when applied at the ratio provided for specified glass spheres to paint (the paint at 15+ 1 mil (381 millimeters + 25 millimeters) wet film thickness equivalent to 100-115 square foot/gallon and the glass spheres at the equivalent rate of 6.0 pounds/gallon. The paint shall be applied with equipment so as to have the paint at a temperature of 130°F to 145°F at the spray gun.
7. Flexible enough to not show cracking or flaking when subjected to TT-P-1952F flexibility test in which the panels used are 3-inch x 5-inch tin plates and 35-31 U.S. Gauge in thickness. The tin panels shall be lightly buffed with steel wool and thoroughly cleaned with solvent before using for tests.
8. Maintain colorfastness for approximately two (2) years and not discolor in sunlight. Color determination shall be made without beads after a minimum of 24 hours.

9. Yellow color shall be a visual match for Federal Specification No. 595-13538. If not a visual match, the diffuse day color shall conform to the following CIE Chromaticity coordinate limits:

	x/y	x/y	x/y	x/y	Brightness
White	0.305 0.295	0.360 0.360	0.388 0.377	0.280 0.310	84.0 min.
Yellow	0.485 0.455	0.506 0.452	0.484 0.428	0.477 0.438	50.0 min.

C. Glass Beads - The glass beads shall conform to the requirements of AASHTO M 247, Type 1.

D. ADA Accessible Parking Pavement Markings - Utilize the Modified International Symbol of Access as shown on the Drawings.

PART 3 - EXECUTION

A. PERFORMANCE
1. Dry and clean areas to be painted of sand and road debris.
2. Apply paint at a rate of 100 to 115 square feet per gallon.
3. Apply glass beads at a rate of six (6) pounds per gallon of paint for painted pavement markings and painted legend, arrows, and markings, and 8 pounds per gallon of paint for hot-applied painted pavement markings.
4. Apply hot-applied paint at a temperature of 130°F to 145°F at the spray gun.
5. Apply paint in a neat and workmanlike manner as shown on plans to produce lines that are sharp, clear, and do not contain feathered edges or fogging.
6. Curves shall maintain consistent radii and lines shall be straight and parallel to the centerline or as shown on the Drawings with no unsightly deviations.
7. Take precautions to prevent tracking of paint by tires of striping equipment.
8. Protect applied paint from crossing vehicles or other traffic for at least the drying time of the paint.

B. ADJUST AND CLEAN
1. Correct deficiencies and unmet tolerances in a manner approved by the Engineer.

END OF SECTION 321723

SECTION 321724 - TRAFFIC SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes traffic signs and appurtenances.

B. Related Sections include the following:
   1. Section 312000 - Earth Moving

1.3 SUBMITTALS

A. Shop Drawings - Submit catalog cuts, design details, manufacturer's literature, and technical data for products and materials appurtenant to this Specification.

B. Certifications - Submit certifications that materials proposed for use meet the requirements of this Specification, as requested by the Engineer.

1.4 REFERENCE STANDARDS

A. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C. ASTM B449 - Standard Specification for Chromates on Aluminum

D. ASTM D4956 - Standard Specification for Retroreflective Sheeting for Traffic Control

E. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

F. ASTM F594 - Standard Specification for Stainless Steel Nuts

PART 2 - PRODUCTS

2.1 SIGNS AND APPURTENANCES

A. Signs and delineators
   1. Retroreflective sheeting materials shall appear on the Connecticut Department of Transportation’s Qualified Product List for the application intended and in accordance with ASTM D4956. Signs shall be Type IV unless Drawings specify the use of Type IX. Signs with fluorescent orange background shall be Type VIII. Delineators shall be Type V.

2. Sheet aluminum sign blanks shall be constructed of sheet aluminum, alloy 6061-T6 or alloy 5052-H38. Sheet aluminum sign blanks shall conform to ASTM B209. They shall be degreased and etched in accordance with the recommendations of the sheeting manufacturer or treated with a light, tightly adherent chromate conversion coating, free of any powdery residue, ranging in color from silvery iridescent to a pale yellow, conforming to ASTM B449, Class 2 10-35 milligrams/square foot with 25 milligrams/square foot as the optimum coating. The aluminum thickness shall be a minimum of 0.10" unless otherwise noted on the Drawings. Plywood thickness for post mounted signs shall be 1/2" exterior grade A-C or better.
3. Silk screening of Type IV or IX retroreflective sheeting shall meet the requirements specified by the retroreflective sheeting manufacturer.

B. Metal Sign Posts - Metal sign posts, square tubular supports and parapet-mounted sign supports shall conform to the requirements as noted on the Drawings. The size, shape and mass of posts and supports shall be as specified in the Drawings. After fabrication of the posts and supports, including hole punching or drilling, they shall be galvanized as noted on the Drawings. All sign posts shall have breakaway features that meet AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals." The breakaway features shall be structurally adequate to carry the signs shown on the Drawings at 60 mph wind loadings. Installations shall be in accordance with manufacturer's recommendations.

C. Sign Mounting Bolts - Bolts used for sign-mounting shall be stainless steel and meet the requirements of ASTM F593, Group 1 or 2 (Alloy Types 304 or 316). Locking nuts shall be stainless steel and shall meet the requirements of ASTM F594, Group 1 or 2 (Alloy Types 304 or 316). Washers shall also be stainless steel and shall meet the requirements of ASTM A240 (Alloy Types 304 or 316).

D. Retroreflective sign post strips shall be provided for regulatory and warning sign posts unless otherwise directed by Engineer. The strip shall be at least two (2) inches in width, shall be placed for the full length of the support from the sign to within two (2) feet above the edge of the roadway, and shall match the background color of the sign, except that the color of the strip for Yield and Do Not Enter Signs shall be red. The retroreflective sign post strips shall not restrict the sign post's breakaway installation.

E. ADA Accessible Parking Signs - Utilize the Modified International Symbol of Access as shown on the Drawings.

PART 3 - EXECUTION

3.1 SIGNS AND APPURTENANCES

A. Placement and dimensions of copy, border and mounting holes shall be as shown in details of the Department of Transportation for Regulatory Warning and Guide Signs which are available for inspection at the Department of Transportation office. Non-reflective copy, border and background shall be applied by the silk-screen process in a manner specified by the retroreflective sheeting manufacturer. The silk screening of all copy, border and background on Type IV or IX retroreflective sheeting shall be accomplished prior to the application of the retroreflective sheeting to the finished aluminum sign blank. Type IV or IX retroreflective sheeting shall be of the heat activated adhesive type and shall be applied in a manner specified by the retroreflective sheeting manufacturer.

B. Apply retroreflective sheeting in such a manner that the finished sign will be wrinkle and bubble free. No splices of the retroreflective sheeting will be permitted on any sign face under thirty (30) square feet in area with one dimension of four (4) feet or less and no more than one splice will be permitted on any one sign without the approval of the Engineer.

C. Direct application of cutout Type IV or IX retroreflective sheeting copy and border shall meet the requirements specified by the retroreflective sheeting manufacturer. Apply cutout copy and border directly to clean, dust free retroreflective sheeting background panels. Neatly cut and butt-join borders at corners and panel joints. Type IV or IX retroreflective sheeting used for direct applied cutout copy and border shall be uniform in brightness and color.

D. Complete the fabrication of aluminum sign blanks including cutting to size and shape and the punching of mounting holes prior to metal degreasing and the application of reflective sheeting. Aluminum sign blanks shall be free of buckles, warp, dents, cockles, burrs and defects resulting from fabrication. Install span-mounted sign brackets and mast arm-mounted sign brackets as shown on the Drawings.

E. Drive metal sign posts or auger the holes in the proper locations as shown on the Drawings. Thoroughly tamp the backfill after the posts have been set level and plumb.

END OF SECTION 321724

SECTION 321726 - TACTILE WARNING SURFACING

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. Cast-in-place Cast Iron detectable warning tiles with rust conditioner treatment.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Adhesive Application:

1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

    a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Deterioration of finishes beyond normal weathering and wear.
    b. Separation or delamination of materials and components.

2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Material: Cast iron, Gray iron ASTM a48 Class 35 B and/or AASHTO M105, Class 35B gray iron and/or ASTM A536 Ductile Iron.
2. Color: Gray iron (unfinished) with rust conditioner treatment.
3. Shapes and Sizes:

    a. Square panel, 24 by 24 inches.

4. Dome Spacing and Configuration: Manufacturer's standard compliant spacing, in square pattern.
5. Mounting:

    a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 or Type 316 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 32 13 13 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.
6. Apply rust conditioning treatment to cast iron detectable warning tiles.

3.4 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

SECTION 321816.13 - PLAYGROUND PROTECTIVE SURFACING (AT PLAYGROUND) – ALTERNATE NO. 3

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. Unitary, seamless surfacing.

B. Related Requirements:
1. Section 012300 “Alternates” for Alternate No. 3 Playscape Surfacing and Underdrainage
2. Section 321816.14 “Recreational Softpave Surfacing” for surfacing within the pool fenceline.

1.3 DEFINITIONS

A. Definitions in ASTM F 2223 apply to Work of this Section.

B. Critical Height: Standard measure of shock attenuation according to ASTM F 2223; same as "critical fall height" in ASTM F 1292. According to ASTM F 1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."

C. SBR: Styrene-butadiene rubber.

D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F 2223.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of protective surfacing.

1. Include plans, sections, placement and penetration details, and attachment to substrates.

2. Include accessories and edge terminations.
3. Include patterns made by varying colors of surfacing and details of graphics.
4. Include fall heights and use zones for equipment and structures, coordinated with the critical heights for protective surfacing.

C. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of protective surfacing and exposed finish.

1. Include Samples of accessories to verify color and finish selection.
2. Unitary, Seamless Surfacing: Minimum 6 by 6 inches.
3. Drainage/Separation Geotextile: Minimum 12 by 12 inches.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of unitary surfacing product.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.

1. Build mockups for protective surfacing including accessories.

a. Size: 48 inches by 48 inches.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Reduction in impact attenuation as measured by reduction of critical fall height.
b. Deterioration of protective surfacing and other materials beyond normal weathering.

2. Warranty Period: 7 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain protective surfacing materials from single source from single manufacturer.

1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.2 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: Critical fall height tested according to ASTM F 1292.

B. Accessibility Standard: Minimum surfacing performance according to ASTM F 1951.

2.3 UNITARY, DUAL-DENSITY, SEAMLESS SURFACING

A. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.

1. Wearing Layer: Formulation of EPDM rubber particles or polyurethane granules, binder, and other organic and inorganic components.
2. Cushioning Layer: Formulation of recycled SBR particles and binder.
3. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
4. Lacquer Topcoat: Manufacturer's standard polyurethane-based formulation.

5. Critical Height: As indicated on Drawings.
6. Overall Thickness: Not less than as required for critical height indicated.
7. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
8. Wearing Layer Color(s): As selected by Architect from manufacturer's full range.

    a. Design: Where colored pattern is required, provide as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.

1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

3.3 INSTALLATION OF SEAMLESS SURFACING

A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.

1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.

    a. Design: Where colored pattern is required, place colored, design material as soon as previously placed material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.

5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
6. Edge Treatment: Flush As indicated on Drawings. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Perform the following tests with the assistance of a factory-authorized service representative:

1. Perform "Installed Surface Performance Test" according to ASTM F 1292 for each protective surfacing type and thickness in each playground area.
2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.

C. Playground protective surfacing will be considered defective if it does not pass tests.

D. Prepare test reports.

3.5 PROTECTION

A. Prevent traffic over seamless surfacing for not less than 48 hours after installation.

END OF SECTION 321816.13

SECTION 321816.14 – RECREATIONAL SOFT PAVE SURFACING

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. This Section includes the following types of playground surface systems and accessories:

1. Non-loose fill systems.

B. Related Sections include the following:

1. Section 033000 "Cast-in-Place Concrete" for substrates.
2. Section 321816.13 "Playground Protective Surfacing" for soft surfacing at playground.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include material descriptions and construction details for each component of playground surface system.

B. Shop Drawings: For each playground surface system, include materials, cross sections, drainage, installation, penetration details, and edge termination.

C. Coordination Drawings: Layout plans and elevations drawn to scale and coordinating installation of playground surface systems with playground equipment. Show playground equipment locations, use zones, fall heights, extent of protective surfacing, and Critical Heights.

D. Color Samples for Initial Selection: Manufacturer's color charts or 6-inch (150-mm) squares of units showing the full range of colors and textures available for components with factory-applied color finishes.

E. Color Samples for Verification: For the following products, for each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Minimum 12-by-12-inch- square sample of non-loose fill surfacing.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

G. Product Certificates: Signed by manufacturers of playground surface systems certifying that protective surfacings furnished comply with requirements.

H. Product Test Reports: From a qualified testing agency indicating playground surface system complies with requirements, based on comprehensive testing of current products.

I. Maintenance Data: For playground surface system to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing work similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.

1. Engage an installer who is certified in writing by playground surface system manufacturer to install playground surface system specified.

B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain primary seamless playground surface system materials, including primers, binders, and rubber particles for cushion-base and wearing-surface layers, through one source from a single playground surface system manufacturer. Provide secondary materials including adhesives, primers, and repair materials of type and from source recommended by manufacturer of primary playground surface system materials.

D. Standards and Guidelines: Provide playground surface systems complying with applicable provisions of the following, unless more stringent provisions are indicated:

1. CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original packages with seals unbroken and bearing manufacturer's labels indicating brand name and directions for storing.

B. Store manufactured materials in a clean, dry location, protected from the weather and deterioration, and complying with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply playground surface system materials or components over wet, frozen, or excessively damp substrates if prohibited by manufacturer's written instructions or warranty requirements.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit playground surface system to be performed according to manufacturer's written instructions or warranty requirements.

C. Field Measurements: Where playground surface system is indicated to fit to other construction, verify dimensions of other construction by field measurements.

D. Adhesively Applied Products: As follows:

1. Apply adhesives only when temperature of surfaces to be adhered to and ambient air temperatures are within range permitted by manufacturer's written instructions.
2. Close area to traffic during surfacing installation and for time period after installation recommended in writing by manufacturer.
3. Do not install products over asphalt paving until paving is sufficiently cured to bond with adhesive.
4. Do not install products over concrete slabs until slabs have cured and are sufficiently dry and surfaces are within acceptable pH range to bond with adhesive, as determined by surfacing manufacturer's recommended procedures.

1.7 COORDINATION

A. Coordinate construction of playground surface systems with installation of playground equipment, including accurate use zones and fall heights, specified in Division 2 Section "Playground Equipment and Structures."

1.8 WARRANTY

A. Provide a three (3) year warranty against failures resulting from wormanship and/or material breakdown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:

1. Seamless Surface System:

a. Aquaflex Porous Surfacing System
b. Safe Guard Surfacing, Corp.
c. GT Impax, Recycled Poured Rubber Surfacing

2.2 PLAYGROUND SURFACE SYSTEMS, GENERAL

A. Accessibility: Provide playground surface system designed to comply with requirements for an accessible route as recommended by ANSI A117.1, U.S. Architectural & Transportation Barriers Compliance Board's "ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)" and Uniform Federal Accessibility Standards for systems designated.

2.3 NON-LOOSE FILL PLAYGROUND SURFACE SYSTEMS

A. General: Provide protective surfacing designed to drain water freely when installed according to manufacturer's written instructions.

B. Seamless Surface: Surfacing formulated for site mixing and application from rubber particles in a polyurethane binder, forming a water-permeable, UV-light-stable, impact-attenuating, seamless playground surface system with layered construction consisting of a lower-density formulation of SBR particles and polyurethane forming a cushion-base layer bonded to higher-density formulation of EPDM rubber particles and polyurethane forming a top-layer wearing surface. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated.

1. Aliphatic Binder: Weather resistant, UV stabilized, flexible, nonhardening, elastomeric single component polyurethane complying with requirements of authorities having jurisdiction for nontoxic and low VOC content.
2. Overall Thickness: Not less than ¾ inch.
3. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location indicated.
4. Color: As selected by Architect from manufacturer's full range.

C. Concrete Leveling and Patching Material: Trowelable, leveling, portland cement based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by playground surface system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade and substrate conditions, for compliance with playground surface system manufacturer's requirements, and for other conditions affecting performance.

B. Hard-Surface Substrates: Verify that substrates are satisfactory for non-loose fill playground surface system installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to playground surface system manufacturer's written requirements for cross-section profile.

1. Concrete Substrates: Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust,

dirt, loose particles, grease, oil, and other contaminates incompatible with playground surface system or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by playground surface system manufacturer.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Verify locations of spray pool perimeter, spray pool equipment, use zones, and pathways. Clearly indicate locations of all piping and drain fittings.

B. General: Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound without high spots, ridges, holes, and depressions.

C. Concrete Substrates: Prepare as follows:

1. Use trowelable leveling and patching materials, according to manufacturer's written instructions, to fill holes and depressions.

3.3 INSTALLATION, GENERAL

A. General: Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated and as required to comply with specified requirements for impact-attenuation performance and, where indicated, for accessibility.

3.4 INSTALLATION OF NON-LOOSE FILL PLAYGROUND SURFACE SYSTEMS

A. Seamless Surface: Mix and apply components of playground surface system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface and impact-attenuating system of total thickness indicated. Proportion each blend of resilient particulate material with binder, in ratio complying with manufacturer's written instructions. Mix components thoroughly to form a uniform dispersion. Coordinate application of components to provide optimum adhesion of playground surface system. Cure successive applications of components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

1. Substrate Primer: Apply according to manufacturer's written instructions over prepared substrate at manufacturer's standard spreading rate for type of substrate.
2. Intercoat Primer: Over cured base course, apply primer at manufacturer's standard spreading rate for maximum adherence of base course to surface course.
3. Surface Course: Spread evenly over primed base course to form a level layer of uniform density and consistency, applied at manufacturer's standard spreading rate in one continuous operation, and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture and allow to cure.

4. Edge Treatment: Flush or as indicated on Drawings. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with safety performance requirements within playground equipment use zones.

3.5 CLEANING AND PROTECTION

A. Non-Loose Fill Systems: Prevent traffic over system for not less than 48 hours after installation. Protect playground surface system from damage and wear during the remainder of construction period. Clean playground surface system after time period recommended in writing by playground surface system manufacturer but not more than four days before dates scheduled for inspections intended to establish date of Substantial Completion. Use cleaning materials and procedures recommended in writing by playground surface system manufacturer.

1. During installation of adhesively applied products, immediately remove visible adhesive from surfaces. Use cleaner recommended by playground surface system manufacturer.

END OF SECTION 321816.14

SECTION 321823 - ATHLETIC SURFACING

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.

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. Section includes Little League baseball skinned sand-clay surfaces as shown on the Drawings and specified herein, including but not necessarily limited to:
   1. Sand cushion.
   2. Infield, home plate and pitcher's mound construction.
   3. Coach's boxes and on-deck circles
   4. Infield soil conditioner.

B. Related Requirements:
   1. ASTM F2107-01E: Standard guide for Construction and Maintenance of Skinned Areas on Sports Fields.
   2. Section 116833 "Athletic Field Equipment" for bases, pitching rubber, home plate, team bench and backstop.
   3. Section 312000 "Earth Moving" for base and sub-grade preparation.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 1 pint in size.

C. Samples for Initial Selection: For each type of unit.

D. Samples for Verification: For each type of unit.

E. Infield mix producer's sieve analysis, product data, and installation instructions.

F. Certified Sieve Analysis of coarse sand.

1.5 FIELD CONDITIONS

A. Schedule work and coordinate installation sequence to accommodate infield and outfield turf installation. Protect installed work and repair any damages.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Infield Mix - Basis-of-Design Product: Subject to compliance with requirements, provide Ballfield Clay Infield Mix as manufactured by Keegan Construction, 75 Valley Service Road, North Haven, CT 06473 203-239-9248 www.keeganmaterials.com or comparable equal product.

1. The material shall meet the following specifications as to particle size:

Particle Fraction	Particle Diameter	Percent
Sand	0.05 to 2.00 mm	between 75 to 85 %
Silt	0.002 to 0.05 mm	remainder
Clay	less than 0.002 mm	between 6 to 10%

2. The skinned infield surface material shall have 100% passing a No. 4 sieve (4.75 mm) with 95-100% passing a No. 10 sieve (2.00 mm). There shall be no more than 10% very coarse sand (1.0-2.0 mm) with the remainder a combined percentage of coarse, medium, fine and very fine sand.

B. Pitcher's Mound - Basis-of-Design Product: Subject to compliance with requirements, provide Pitcher's Mound Clay as manufactured by Keegan Construction, 75 Valley Service Road, North Haven, CT 06473 203-239-9248 www.keeganmaterials.com or comparable equal product.

C. Calcined Clay Soils Conditioner – Basis-of-Design Product: Subject to compliance with requirements, provide Turface Pro League as manufactured by Profile Products (800) 207-6457 or comparable equal product approved by the Landscape Architect.

D. Sand Cushion– Conform to Form 817-2016, Article M.03.01-2, Fine Aggregate.

PART 3 - EXECUTION

3.1 GENERAL

A. Install to the lines, grades and details as shown on the Drawings and in conformance with the material producer's written instructions and recommendations.

B. Verify that the subgrade has been properly prepared and compacted.

3.2 PREPARATION

A. Place forms along the edges of the skinned area of the infield including base paths before installing materials. Remove the forms after installation and fill the voids.

B. Mix calcined clay with infield mix prior to installation. Uniformly blend products at a rate recommended by calcined clay manufacturer. Mixing procedures and blended materials shall be subject to the Owner's approval.

3.3 INSTALLATION

A. Place the base sand cushion at a uniform 4-inch depth on the infield, spreading the material using a track machine. Prevent grading equipment from disturbing the subgrade. Wet and roll the base sand before placing the infield material.

B. Place the infield material over the base sand cushion layer to a uniform compacted depth of 4-inches, dumping the material on the edges of the areas and spreading the material onto the base sand. Equipment is to be kept off the base sand at all times.

3.4 INFIELD SURFACING

A. The skinned infield material is to be packed to a bulk density (oven dry at 105 degrees C) of between 103-106 lbs.per cubic foot.

B. Surface shall be smooth and shall be pitched for drainage as indicated on the Drawings. Tolerance : ½-inch in 10 feet.

C. Moisten, patch low spots, roll and drag to create a firm playing surface with a soft cushion for safe sliding. Surface shall retain only enough moisture for resilience.

D. Insure that the infield finish surface grades conform with grading plans. Insure that the lawn grades and skined surfaces are flush to each other, and that drainage patterns are not interrupted.

3.5 PITCHER'S MOUND

A. Place pitcher's mound material as detailed. Construct by adding 2 inches of mound mix and tamping each layer until dimension of mound is obtained. Moisten the material as required so that the material can be adequately compacted.

3.6 PROTECTION

A. Maintain proper drainage to prevent washouts and flooding. Protect from damage and make repairs as required.

3.7 MAINTENANCE

A. Maintain until final acceptance by raking and rolling, to produce a smooth even surface with no weeds or other debris. Infield surfacing will not be accepted until all lawn areas are installed, maintained and accepted.

B. Repair any settlements by installing additional material and rolling to a smooth surface.

END OF SECTION 321823

SECTION 321823.43 - RECREATIONAL COURT SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.2 SUMMARY

A. Section Includes:

1. Basketball Court Surfacing System over new bituminous paving including:

a. Court Patch Binder
b. Surface Filler Coat
c. Court Base Texture Course (Coarse)
d. Court Surface Texture Course (Fine)
e. Coloring Additive
f. Line Striping Paint

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For surfacing finish layout and striping.

1. Include patterns made by varying colors of surfacing and details of graphics.

C. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of manufacturers standard color selection for court surfaces and line striping.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For court surfacing to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Court Surface Texture Course: 5 gallons.
2. Court Line Surfacing Paint: 2 gallons.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Manufacturer Qualifications:

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of court surfacing that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: "Plexicourt System Mutisport Surfacing (Fine) by Plexipave, A Division of California Products Corporation, 150 Dascombe Road, Andover, MA (800) 225-1141 www.plexipave.com or "Approved Equal".

2.2 COURT PATCH BINDER

A. "Court Patch Binder" as manufactured by Plexipave.

1. High-strength acrylic latex bonding liquid.
2. Fast drying and setting.

3. Used for patching or leveling new bituminous, up to 3/4" depth.

2.3 SURFACE FILLER COAT

A. "Acrylic Resurfacer" as manufactured by Plexipave.

1. Filler coat to reduce the porosity of the asphalt or concrete surface.
2. Contains no asbestos.
3. Mix with 60-80 mesh fillers (Sand)

2.4 COURT BASE TEXTURE COURSE (COARSE)

A. "Acrylotex MA" as manufactured by Plexipave.

1. Durable, 100% acrylic coating designed for use on asphalt and concrete surfaces.
2. Contains 60-80 mesh fillers

2.5 COURT SURFACE TEXTURE COURSE (FINE)

A. "Acrylotex LA" as manufactured by Plexipave.

1. Durable, 100% acrylic coating designed for use on asphalt and concrete surfaces.
2. Contains 80-100 mesh fillers

2.6 COLORING ADDITIVE

A. "Plexichrome" as manufactured by Plexipave.

1. Highly pigmented acrylic coating used in conjunction with Court Base Texture Course and Court Surface Texture Course to provide a uniformly textured surface.
2. Color: to be selected by Landscape Architect from full line of manufacturer's standard colors.

2.7 LINE STRIPING PAINT

A. "Plexicolor Line Paint" as manufactured by Plexipave.

2.8 SAND

A. Fine aggregate shall be natural or manufactured sand consisting of clean, hard, durable, uncoated particles of quartz or other rock, free from lumps of clay, soft or flaky material, mica, loam, organic or other injurious material. In no case shall fine aggregate containing lumps of frozen material be used.

B. Gradations shall meet the requirements of the specific use of fillers listed above.

2.9 WATER

A. Potable and complying with ASTM C 94/C 94M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.

1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain.

1. Asphalt Substrates: Verify that substrates are dry, sufficiently cured to bond with adhesive, and free from surface defects, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

B. General Application:

1. Do not use in temperatures below 55 degrees F or when rain or high humidity is imminent.
2. Ambient temperature must be 55 degrees F and rising.
3. Do not apply when surface temperature is above 140 degrees F.

C. Asphalt:

1. Allow asphalt to cure a minimum of 14 days.

2. Flood the entire surface area and check for minor depressions or irregularities.
3. Any puddled area covering an area the size of a nickel or larger shall be marked and repaired with Court Patch Binder.

D. Court Patch Binder:

1. Apply a tack coat consisting of 1 part Court Patch binder and 2 parts water to the patch areas and allow to dry thoroughly prior to reparing.
2. Mixes:

    a. Thin Patches 1/4" or Less

        1) 100 lbs. #80-100 mesh silica sand (dry)
        2) 3 gallons Court Patch Binder
        3) 1 to 2 gallons Portland Cement (dry, minimum of 12 lbs, maximum of 24 lbs.)
        4) DO NOT ADD WATER.

    b. Thick Patches 1/4" or Greater

        1) 100 lbs. #60-80 mesh silica sand (dry)
        2) 3 gallons Court Patch Binder
        3) 1 to 2 gallons Portland Cement (dry, minimum of 12 lbs, maximum of 24 lbs.)
        4) DO NOT ADD WATER.

    c. Mix in a clean mortar box or mortar mixer to a workable consistency. Thoroughly clean and apply a tack coat as described above.

3. Application:

    a. Court Patch Binder mix may be applied directly to the depressed area after the tack coat has completely dried.
    b. The patch should be allowed to cure for a minimum of 24 hours prior to the application of the Plexipave Color Surface System.
    c. Depressions in excess of 3/4" depth must receive multiple applications of Court Patch Binder Mix, allowing 24 hours before applying subsequent lifts.
    d. Each application of Court Patch mix must be feathered out to a fine edge.
    e. Any rough edges must be rubbed down with an abrasive rubbing stone to remove roughness.

4. Coverage: See manufacturers recommended coverage guidelines.

E. Court Surface Filler Coat:

1. Application of the Surface Filler Coat Mix shall be applied to a clean, dry, level surface.
2. Mix:

    a. Acrylic Resurfacer 55 gallons

b.	Water (clean and potable)	20-40 gallons
c.	Sand (60-80 mesh)	600-900 pounds
d.	Liquid Yield	112-138 gallons

3. Use clean dry sand and clear potable water to make mixes.
4. Mix the ingredients thoroughly in a mortar box or mortar mixer.
5. Apply the Surface Filler Coat mix with a 70 Durometer rubber bladed squeegee in windrow on the surface with sufficient quantity to cover as the squeegee is pulled over the surface.
6. Apply the Surface Filler Coat Mix in one or two coats (depending on surface porosity) at a rate of .05-.07 gallons per square yard per coat.
7. Allow the application of Surface Filler Coat Mix to dry thoroughly. Scrape off all ridges, and rough spots prior to any subsequent application of surface filler or texture course.

F. Court Base Texture Course (Coarse) and Coloring Additive:

1. Application of the base texture course shall be applied to a clean, dry level surface.
2. Mix:

a.	Acrylotex MA	30 gallons
b.	Plexichrome	15 gallons
c.	Water	20 gallons

3. Apply the Base Texture Course with a rubber bladed squeegee in at least two applications to achieve a total application rate prior to dilution as recommended by the manufacturer.
4. No application shall be covered by a succeeding application until thoroughly cured.
5. Color to be selected by the Landscape Architect from the full range of the Manufacturer's Standard colors.

G. Court Surface Texture Course (Fine) and Coloring Additive:

1. Application of the surface texture course shall be applied to a clean, dry level surface.
2. Mix:

a.	Acrylotex LA	30 gallons
b.	Plexichrome	15 gallons
c.	Water	20 gallons

3. Apply the Base Texture Course with a rubber bladed squeegee to achieve a total application rate prior to dilution as recommended by the manufacturer.
4. No application shall be covered by a succeeding application until thoroughly cured.
5. Color to be selected by the Landscape Architect from the full range of the Manufacturer's Standard colors.

H. Line Striping Paint:

1. Application of line striping paint shall be applied to a clean, dry level surface.

2. Designated game lines shall be marked in accordance with the drawings.
3. Markings shall be made using the designated color.

3.3 PROTECTION

A. Prevent traffic over surfacing for not less than 48 hours after installation.

END OF SECTION 321823.43

SECTION 323113 - CHAIN-LINK FENCES AND GATES

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. This Section includes the following:

1. Chain-Link Fences: Industrial.
2. Gates: Swing and Rolling.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" and “Structural Backfill” for site excavation, fill, and backfill where chain-link fences and gates are located.

2. Division 3 Section Cast-in-Place Concrete for bases.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Minimum Post Size and Maximum Spacing for Wind Velocity Pressure: Determine based on mesh size and pattern specified, and on the following minimum design wind pressures and according to CLFMI WLG 2445:

a. Wind Speed: 95 mph.
b. Fence Height: As specified on Drawings.
c. Line Post Group: IA, ASTM F 1043, Schedule 40 steel pipe.
d. Wind Exposure Category: II

2. Determine minimum post size, group, and section according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet .

B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

C. Samples for Verification: For each type of chain-link fence and gate indicated.

D. Product Certificates: For each type of chain-link fence, and gate, signed by product manufacturer.

1. Strength test results for framing according to ASTM F 1043.

E. Qualification Data: For Installer.

F. Field quality-control test reports.

G. Maintenance Data: For the following to include in maintenance manuals:

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1. Engineering Responsibility: Preparation of data for chain-link fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Include ten (10) ft. length of fence and gate complying with requirements.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Chain Link Fencing and Swing Gates, Basis of Design Product: The design of the chain-link fencing is based on the product of Anchor Fence/Master-Halco, Baltimore, MD, Phone (410) 676-2744 Fax (410) 676-7098. Subject to compliance with requirements, provide the named product, or an equivalent product of another manufacturer.

2.2 CHAIN-LINK FENCE FABRIC – POOL ENCLOSURE

A. General: Height indicated on Drawings. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:

1. Steel Wire Fabric: Metallic wire with a diameter of 0.148 inch.

a. Mesh Size: 1 ¼ inch .
b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied before weaving.
c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

2. Selvage: Knuckled at both selvages.

2.3 CHAIN-LINK FENCE FABRIC – BASEBALL SIDELINES AND BACKSTOP

A. General: Height indicated on Drawings. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:

1. Steel Wire Fabric: Metallic wire with a diameter of 6 gauge for the bottom.

a. Mesh Size: 2 inch.
b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied before weaving.
c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.

2. Selvage: K & K, knuckled top and bottom.

2.4 INDUSTRIAL FENCE FRAMING – POOL ENCLOSURE

A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:

1. Group: IA, round steel pipe, Schedule 40 or as required for structural loading.
2. Fence Height: As indicated on Drawings.
3. Strength Requirement: Heavy industrial according to ASTM F 1043.
4. Post Diameter and Thickness: According to ASTM F 1043.

    a. Top Rail: 1.66 inches.
    b. Line Post: 2.375 inches.
    c. End, Corner and Pull Post: 2.875 inches.
    d. Swing Gate Post: According to ASTM F 900.

5. Coating for Steel Framing:

    a. Metallic Coating:
        1) External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc pigmented coating.

2.5 INDUSTRIAL FENCE FRAMING – BASEBALL SIDELINES AND BACKSTOP

A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:

1. Group: IA, round steel pipe, Schedule 40 or as required for structural loading.
2. Fence Height: As indicated on Drawings.
3. Strength Requirement: Heavy industrial according to ASTM F 1043.
4. Post Diameter and Thickness: According to ASTM F 1043.

    a. Top Rail: 1.66 inches at sidelines. 4” minimum at backstop.
    b. Line Post: 2.375 inches at sidelines. 4” minimum at backstop.
    c. End, Corner and Pull Post: 2.875 inches at sidelines. 4” min. at backstop.

5. Coating for Steel Framing:

    a. Metallic Coating:
        1) External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc pigmented coating.

2.6 INDUSTRIAL SWING GATES

A. General: Comply with ASTM F 900 for single and double swing gate types.

1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.

B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:

1. Gate Fabric Height: 2 inches less than adjacent fence height.
2. Leaf Width: As indicated.
3. Frame Members:

a. Tubular Steel: 1.90 inches round.

C. Frame Corner Construction:

1. Welded and 5/16-inch diameter, adjustable truss rods for panels 5 feet wide or wider.

D. Hardware materials: Hot dipped galvanized steel, stainless steel or malleable iron shapes to suit gate size. Field coat moveable parts (e.g. hinges, latch, keeper, and drop bar) with Galvanized touch up paint, provided by manufacturer, to match adjacent finishes.

1. Hinges: Spring type, equivalent to D&D Technologies, Gateware, Heavy-Duty Round Post Hinge. Structurally capable of supporting gate leaf and allow opening and closing without binding. Provide not less than manufacturer's recommended quantity based on size of gate. Non-lift-off type hinge design shall permit gate to swing 180° inward or 180° outward.

2. Latch:

a. Drive Gates: Forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.
b. Exit Gates: Latch integral with panic rail exit device. Provide hasp for padlock for use off-hours.

3. Panic Rail Exit Device:

a. At Perimeter Exit Gates: Provide hardware equivalent to Von Duprin, 99NL, key only, no pull on outside. Provide with 99ALK Alarm Kit and decal to read "EMERGENCY EXIT ONLY, ALARM WILL SOUND". Provide US 26 finish, stainless steel. BHMA Number A625.

4. Keeper: Provide keeper for each gate leaf over 5' wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

5. Double gates: Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.

2.7 HORIZONTAL-SLIDE GATES

A. General: ASTM F 1184 for gate posts and single sliding gate types.

1. Classification: Type I Overhead Slide.

a. Gate Leaf Width: 6-feet.
b. Framework Member Sizes and Strength: Based on gate fabric height 84 inches.

2. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.

a. Gate Frame Width and Height: 72 inches wide 84 inches high.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Protective coating and finish to match fence framework
2. Gate Posts: ASTM F 1184. Provide round tubular steel posts.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.
2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
3. Lock: Manufacturer's standard internal device.

2.8 FITTINGS

A. General: Comply with ASTM F 626.

B. Post and Line Caps: Provide for each post.

1. Line post caps with loop to receive top rail.

C. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.148-inch diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

2.9 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more or as indicated on Drawings.

D. Line Posts: Space line posts uniformly at maximum 10 feet o.c., unless otherwise shown.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 6 feet (1.83 m) or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Bottom Rails: Install, spanning between posts.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of 1500 feet.
3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
4. Ground fence on each side of gates and other fence openings.

    a. Bond metal gates to gate posts.
    b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

E. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
4. Make above-grade ground connections with mechanical fasteners.

5. Make below-grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

G. Comply with requirements in Section 264113 "Lightning Protection for Structures."

3.6 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.7 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates. Refer to Division 1 Section "Closeout Procedures and Demonstration and Training."

END OF SECTION 323113

SECTION 329115 - SOIL PREPARATION (PERFORMANCE SPECIFICATION)

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 planting soils specified according to performance requirements of the mixes.

B. Related Requirements:
1. Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 32 92 00 "Turf and Grasses" for placing planting soil for turf and grasses.
3. Section 32 93 00 "Plants" for placing planting soil for plantings.

1.3 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include recommendations for application and use.
   2. Include test data substantiating that products comply with requirements.
   3. Include sieve analyses for aggregate materials.
   4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
      a. Manufacturer's qualified testing agency's certified analysis of standard products.
      b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
      c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 4-L (1-gal.) volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and imported soil.
   1. Notify Architect seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
   1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.9 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Landscape Architect under the direction of the testing agency.
   1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.

2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:
1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
b. Hydrometer Method: Report percentages of sand, silt, and clay.

C. Chemical Testing:
1. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT NEC-67, including the following:
1. Percentage of organic matter.
2. Soil reaction (acidity/alkalinity pH value).
3. Nitrogen ppm.
4. Phosphorous ppm.
5. Potassium ppm.
6. Manganese ppm.
7. Calcium ppm.
8. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 100 sq. m (1000 sq. ft.) for 150-mm (6-inch)depth of soil.

2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 100 sq. m (1000 sq. ft.) for 150-mm (6-inch)depth of soil.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.

C. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS

A. Planting-Soil Type I: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Using preconstruction soil analyses and materials specified in other articles of this Section, amend existing, on-site surface soil to become planting soil complying with the following requirements:
1. Percentage of Organic Matter: 5 to 8 percent by volume.
2. Soil Reaction: pH of 6 to 7.
3. Fertility: N,P, K, Mg, and Ca in amounts recommended by the testing laboratory for the turf types and plant groups to be installed..

B. Planting-Soil Type II: Imported, naturally formed soil from off-site sources and consisting of sandy loam or loam soil according to USDA textures; and modified to produce viable planting soil. Amend imported soil with materials specified in other articles of this Section to become planting soil complying with the following requirements:
1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep, not from bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.

2. Additional Properties of Imported Soil before Amending: Minimum of 2 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration. Clean soil to be of the following:
   a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
   b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the imported soil.
   c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 1 1/4 inches in any dimension.
3. Percentage of Organic Matter: Minimum 5 to 8 percent by volume.
4. Soil Reaction: pH of 6 to 7.
5. Fertility: N, P, K, Mg, and Ca in amounts recommended by the testing laboratory for the turf types and plant groups to be installed.

C. Planting-Soil Type III: Soil Filter Mix
1. Soil Filter Mix soil shall be composed by the following volumes:
   a. Topsoil 30%
   b. Compost 20%
   c. Sand 50%

2.2 ORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Percent by weight passing through square mesh sieves:
   a. 100 percent passing No. 10 sieve.
   b. Minimum 90 percent passing No. 20 sieve.
   c. Minimum 40 percent passing No. 100 sieve.
2. Form: Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a 3.35-mm (No. 6) sieve and a maximum of 10 percent passing through a 0.425-mm (No. 40) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

E. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
1. Feedstock: May include biosolids.
2. Reaction: pH of 5.5 to 8.

3. Soluble-Salt Concentration: Less than 4 dS/m.
4. Moisture Content: 35 to 55 percent by weight.
5. Organic-Matter Content: 40 to 60 percent of dry weight.
6. Particle Size: Minimum of 98 percent passing through a ¾ inch sieve.

2.3 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. 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 formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

2.4 Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a depth of 150 mm (6 inches) and stockpile until amended.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a combined maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a 50-mm (2-inch) sieve to remove large materials.

3.3 PLACING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 100 mm (4 inches). Remove stones larger than 50 mm (2 inches) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 50 mm (2 inches) of subgrade. Spread remainder of planting soil.

C. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.

D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACEMENT AND COMPACTION OF SOIL FILTER MIX PLANTING SOILS IN RAIN GARDENS

A. The Soil Filter Mix planting soil shall be placed and graded using low ground-contact pressure equipment or by excavators and/or backhoes operating on the ground adjacent to the rain garden.

B. No heavy equipment shall be used within the perimeter of the raingarden perimeter before, during or after the placement of the Soil Filter Mix planting soil.

C. The Soil Filter Mix planting soil shall be placed in horizontal layers not to exceed 12 inches for the entire area of the rain garden.

D. The Soil Filter Mix planting soil shall be compacted by saturating the entire area of the rain garden after each lift of soil is placed until water flows from the underdrain. Water for saturation shall be applied by spraying or sprinkling. Saturation of each lift shall be performed in the presence of the Landscape Architect. An appropriate sediment control device shall be used to treat any sediment-laden water discharged from the underdrain.

E. Final grading of the rain garden shall be performed after a 24-hour settling period.

F. If the Soil Filter Mix planting soil becomes contaminated during the construction of the basin, the contaminated material shall be removed and replaced with uncontaminated material.

G. Do not use pesticides, herbicides or fertilizers in the rain gardens.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:
   1. Performance Testing: For each amended planting-soil type, demonstrating compliance with specified performance requirements. Perform testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

C. Soil will be considered defective if it does not pass tests.

D. Prepare test reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.6 PROTECTION

A. Protection Zone: Identify protection zones according to Section 01 56 39 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Vehicle traffic.
   4. Foot traffic.
   5. Erection of sheds or structures.
   6. Impoundment of water.
   7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.7 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

C. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329115

SECTION 329200 - TURF AND GRASSES

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. Lawn Seeding.
2. Athletic Field Seeding.
3. Hydroseeding.
4. Basin Bottom Seed Mix.
5. Basin Slope Seed Mix.
6. Restoration Seed Mix.

B. Related Requirements:
1. Section 32 91 15 “Soil Preparation (Performance Specification) for planting soil.
2. Section 32 93 00 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.
3. Section 334000 "Storm Drainage Systems" for below-grade drainage of landscaped areas.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 15 "Soil Preparation (Performance Specification)" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of lawn turf, athletic field turf, restoration mix and wet mix planting areas during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn turf, athletic field turf, conservation/wildlife and detention basin planting area establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 01 40 00 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawncare Manager.
    c. Landscape Industry Certified Lawncare Technician.

5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Lawn and Athletic Field Seeding:
   a. Spring Planting: April 1 to June 1.
   b. Fall Planting: August 15 to October 1.

2. Basin Bottom, Basin Slope, and Restoration Seeding:
   a. Spring Planting: March to May 15.
   b. Fall Planting: August 15 to September 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.10 WARRANTY

A. Special Warranty: Installer agrees to repair or replace areas of turf, wet mix and conservation/wildlife mix that fail in materials or workmanship within specified maintenance periods listed in Article 3.12.

PART 2 - PRODUCTS

2.1 LAWN SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: State-certified seed of grass species as listed below for solar exposure.
2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed.
3. Sun and Partial Shade: Proportioned by weight as follows:

    a. 35 percent Kentucky bluegrass (Poa pratensis).
    b. 35 percent creeping red fescue (Festuca rubra variety).
    c. 20 percent “Fiesta 4” perennial ryegrass.
    d. 10 percent “Express II” perennial ryegrass.

2.2 ATHLETIC FIELD SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: State-certified seed of grass species as listed below for solar exposure.
2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
3. Sun and Partial Shade: Proportioned by weight as follows:

    a. 25 percent Futura Granite Kentucky bluegrass.
    b. 25 percent America Kentucky Bluegrass.
    c. 25 percent Bandera Texas Hybrid Bluegrass.
    d. 12.5 percent Cutter II Perennial Ryegrass.
    e. 12.5 percent Dasher 3 Perennial Ryegrass.

2.3 BASIN BOTTOM SEED MIX

A. Basin Bottom Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: Seed of grass and wildflower species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
2. Species to be included as follows:
   a. Elymus virginicus – Virginia Wild Rye
   b. Festuca rubra – Creeping Red Fescue
   c. Schizachyrium scoparium – Little Bluestem
   d. Andropogon gerardii – Big Bluestem
   e. Panicum virgatum – Switch Grass
   f. Verbena hastata – Blue Vervain
   g. Agrostis scabra – Rough Bentgrass/ Ticklegrass
   h. Aster novae-angliae – New England Aster
   i. Eupatorium maculatum – Spotted Joe Pye Weed
   j. Eupatorium perfoliatum - Boneset
   k. Juncus effuses – Soft Rush
   l. Scirpus cyperinus – Wool Grass

2.4 BASIN SLOPE SEED MIX

A. Basin Slope Seed Mix: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:
   1. Quality: 50:50 blend of the below listed seed mixes. Seed of selected grass and wildflower species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
   2. Seed Species:
      a. Seed Mix A to contain the following:
         1) Schizachyrium scoparium – Little Bluestem
         2) Festuca rubra – Creeping Red Fescue
         3) Sorghastrum nutans – Indian Grass
         4) Elymus canadensis – Canada Wild Rye
         5) Elymus virginicus – Virginia Wild Rye
         6) Chamaecrista fasciculata – Partridge Pea
         7) Desmodium canadense – Showy Tick Trefoil
         8) Helenium autumnale – Common Sneezeweed
         9) Rudbeckia hirta – Black Eyed Susan
         10) Verbena hastata – Blue Vervain
         11) Monarda fistulosa – Wild Bergamot
         12) Asclepias syriaca – Common Milkweed
         13) Aster laevis – Smooth Blue Aster
         14) Aster novae-angliae – New England Aster
         15) Eupatorium maculatum – Spotted Joe Pye Weed
         16) Penstemon digitalis – Beard Tongue

17) Sisyrinchium angustifolium – Narrowleafed Blue Eyed Grass
18) Veronia noveboracensis – New York Ironweed
19) Zizia aurea – Golden Alexanders
20) Aster lateriflorus – Starved/ Calico Aster
21) Euthamia graminfolia – Grass Leaved Goldenrod
22) Solidago juncea – Early Goldenrod

b. Seed Mix B to contain the following:
1) Festuca rubra – Creeping Red Fescue
2) Elymus canadensis – Canada Wild Rye
3) Lolium multiflorum – Annual Ryegrass
4) Lolium perenne – Perennial Ryegrass
5) Bouteloua gracilis – Blue Grama
6) Schizachyrium scoparium – Little Bluestem
7) Sorghastrum nutans – Indian Grass
8) Agrostis scabra – Rough Bentgrass/ Ticklegrass
9) Agrostis perennans – Upland Bentgrass

2.5 RESTORATION SEED MIX

A. Restoration Seed Mix: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:
1. Quality: Seed of selected grasses as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
2. Species to be included as follows:
a. Festuca rubra – Creeping Red Fescue
b. Elymus canadensis – Canada Wild Rye
c. Lolium multiflorum – Annual Ryegrass
d. Lolium perenne – Perennial Ryegrass
e. Bouteloua gracilis – Blue Grama
f. Schizachyrium scoparium – Little Bluestem
g. Sorghastrum nutans – Indian Grass
h. Agrostis scabra – Rough Bentgrass/ Ticklegrass
i. Agrostis perennans – Upland Bentgrass

2.6 FERTILIZERS

A. Do not use fertilizers on basin bottom, basin slope or restoration seed mix areas..

B. Commercial Fertilizer for Lawn and Athletic Turf: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.7 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.8 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 15 "Soil Preparation (Performance Specification)."

B. Placing Planting Soil: Place planting soil in place over exposed subgrade or place manufactured planting soil over exposed subgrade.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate as recommended by the seed distributor..

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Hydroseeding methods are not to be used on areas designated for Basin Slope Seed Mix.

3.6 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow lawn turf to a height of 1-1/2 to 2 inches.
2. Mow athletic turf to a height of 1-1/2 inches.

D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen in amounts recommended in soil reports from a qualified soil-testing laboratory.

3.7 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.8 BASIN BOTTOM, BASIN SLOPE, AND RESTORATION SEED MIX

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Before sowing, mix seed with seed carrier at a ratio recommended by the seed distributor.
2. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
3. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at a total rate as recommended by the seed distributor.

C. Brush seed into top 1/16 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

E. Water newly planted areas and keep moist until meadow is established.

3.9 BASIN BOTTOM, BASIN SLOPE, AND RESTORATION SEED MIXMAINTENANCE

A. Delineate lawn areas from Basin Bottom, Basin Slope, and Restoration Seed Mix areas with flagged wooden stakes and twine connecting each stake to prevent conventional mowing practices within non-lawn areas.

B. Maintain and establish basin bottom, basin slope and restoration seed mixes by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable area. Roll, regrade, and replant bare or eroded areas and remulch. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and meadow damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Spot treat as required to keep meadow and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

C. Watering: Install and maintain temporary piping, hoses, and meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water meadow with fine spray at a minimum rate of 1/2 inch per week for six weeks after planting unless rainfall precipitation is adequate.

D. Mowing: Mow to a height of 6-8” once vegetation is 12” tall (every 6 weeks). Mow to a height of 6-8” in late winter.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.12 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
2. Turf will not be accepted in pieces unless otherwise shown on the Drawings or approved by the Owner.
3. No turf areas will be accepted prior to the Substantial Completion of this Contract.
4. No turf areas will be accepted prior to the completion of a minimum of 5 mowings.

B. Basin Bottom, Basin Slope and Restoration Seed Mix Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in " Basin Bottom, Basin Slope and Restoration Seed Mix Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than maintenance period below.
1. Maintenance Period: 60 days from date of Substantial Completion.

END OF SECTION 329200

SECTION 329300 - PLANTS

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. Plants.
2. Tree stabilization.
3. Tree-watering devices.
4. Landscape edgings.

B. Related Requirements:
1. Section 012300 “Alternates” for Selective Plantings Alternate No. 4.
2. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
3. Section 329115 “Soil Preparation (Performance Specification)” for topsoil used in planting mix.
4. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

G. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

H. Planting Area: Areas to be planted.

I. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Soil Preparation (Performance Specification)" for drawing designations for planting soils.

J. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

M. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:

1. Organic Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
2. Proprietary Root-Ball-Stabilization Device: One unit.
3. Slow-Release, Tree-Watering Device: One unit of each size required.
4. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Horticultural Technician.

5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.11 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
   1. Spring Planting:
      a. Deciduous plants: March 1 through May 15.
      b. Evergreen plants: March 1 through June 1.
      c. Perennial plants and ornamental grasses: Plant in spring after all danger of frost has passed. Do not plant while ground is still wet or sticky after thawing or heavy from prolonged rain. Complete this work before June 1.

   2. Fall Planting:
      a. Deciduous plants: October 15 until the ground freezes.
      b. Evergreen plants: August 15 through October 1.
      c. Bulbs: September 1 until the ground freezes.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

   1. Failures include, but are not limited to, the following:

      a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
      b. Structural failures including plantings falling or blowing over.
      c. Faulty performance of tree stabilization and edgings.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

   2. Warranty Periods: From date of Substantial Completion.

      a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
      b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

   3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Size: 5-gram tablets.
2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Double-shredded bark mulch.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural brown.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2.4 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
3. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
4. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
5. Guy Cables: Five-strand, 3/16-inch-diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
6. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.6 LANDSCAPE EDGINGS

A. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

1. Edging Size: 1/8 inch thick by 5-1/2 inches deep.
2. Stakes: Aluminum, ASTM B 221, Alloy 6061-T6, approximately 1-1/2 inches wide by 12 inches long.
3. Finish: Mill (natural aluminum).

2.7 TREE-WATERING DEVICES

A. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

1. Color: As selected by Architect from manufacturer's full range.

2.8 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA U1, Use Category UC4a; acceptable to authorities having jurisdiction, and containing no arsenic or chromium.

B. 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 written instructions.

C. Burlap: Non-synthetic, biodegradable.

D. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation (Performance Specification)."

B. Placing Planting Soil: Place manufactured planting soil over exposed subgrade.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
7. Maintain supervision of excavations during working hours.
8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
9. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, 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 planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 3-inches above adjacent finish grades.

1. Backfill: Planting soil.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: As indicted by manufacturer.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 3-inches above adjacent finish grades.

1. Backfill: Planting soil.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

a. Quantity: As indicated by manufacturer.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

A. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated.

1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.

   a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide turnbuckle for each guy wire and tighten securely.
   b. Support trees with guy cable or multiple strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
   c. Attach flags to each guy wire, 30 inches above finish grade.
   d. Paint turnbuckles with luminescent white paint.

2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.8 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 24-inch radius around trunks or stems. Do not place mulch within 6 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.10 EDGING INSTALLATION

A. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's written instructions. Anchor with aluminum stakes spaced approximately 36 inches apart, driven below top elevation of edging.

3.11 INSTALLING SLOW-RELEASE WATERING DEVICE

A. Provide one device for each tree.

B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.12 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.14 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree.

2. Species of Replacement Trees: Same species being replaced.

3.15 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.16 MAINTENANCE SERVICE

A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months from date of Substantial Completion.

B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION 329300

SECTION 331000 - EXTERIOR WATER DISTRIBUTION SYSTEM

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. Underground water distribution system from municipal water mains to within five (5) feet of building foundations for conveyance of potable (domestic) water.
2. Related valves, and piping appurtenances.
3. Testing and disinfection.
4. Cut and cap existing water utility lines when no longer required.

B. Related Requirements:
1. Section 024116 Structure Demolition
2. Division 3 - Concrete
3. Division 13 - Swimming Pool Piping
4. Division 22 - Plumbing: Piping within buildings to five (5) feet outside of buildings.
5. Section 312000 - Earth Moving
6. Section 312333 - Trenching

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

1.4 INFORMATIONAL SUBMITTALS

A. Submit Shop Drawings for approval showing products and materials proposed for use for piping, fittings, valves and appurtenances.

1.5 COORDINATION WITH UTILITY COMPANY

A. Coordinate with the New Britain Water Department. All fees by the New Britain Water Department will be paid by the Owner directly.

1.6 QUALITY ASSURANCE

A. All components shall be NSF 61 listed for potable water use.

B. Comply with material and installation requirements of New Britain Water Department.

1.7 PROTECTION

A. Be solely responsible for construction methods, means, techniques and for construction site safety precautions. Conduct construction operations in conformance with all applicable local, State and Federal safety laws, rules, regulations and codes.

1.8 PERMITS

A. Register for General Permit for the Discharge of Hydrostatic Pressure Testing Wastewater with the Connecticut Department of Energy and Environmental Protection. A fact sheet, the general permit and registration forms may be downloaded at:

http://www.ct.gov/dep/cwp/view.asp?a=2709&q=324212&depNav_GID=1643#HydrostaticGP

B. Pay fees and meet all permit requirements for registration, treatment, monitoring and reporting.

PART 2 - PRODUCTS

2.1 PIPING 3-INCH AND LARGER - DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall have push on joints except where mechanical joints or flexible couplings are indicated upon the Drawings. Fittings shall have mechanical joints. The pipe shall conform to current ANSI Specifications A21.51. Mechanical joint, push on joint, and plain end pipe shall be thickness class 52 unless otherwise specified or noted on the Drawings.

B. Fittings shall be mechanical joint, ductile iron, and shall conform to ANSI Specification A21.53, 350 psi working pressure. Joints shall conform to ANSI Specification A21.11.

C. Pipe and fittings shall be cement mortar lined on the inside in accordance with ANSI Specification A21.4 latest edition, except that the cement lining shall be double thickness. Thickness shall be not less than 1/8-inch for 4-12 inch pipe, 3/16-inch for 14-24 inch pipe, and 1/4-inch for 30-inch pipe.

D. Pipe and fittings shall be coated on the outside in accordance with ANSI Specification A21.51.

E. All ductile iron fittings shall be marked in accordance with ANSI Specification A21.10, and all ductile-iron pipe shall be marked in accordance with ANSI Specifications A21.51. Marking shall also include the manufacturer's initials, year cast, and class letter or number. Mark number and weight shall be conspicuously painted on each piece.

F. All ductile iron pipe and fittings will be subject to inspection and approval by the Architect after delivery of material to job site. No broken, cracked, misshapen, imperfectly coated, otherwise unsatisfactory or damaged ductile iron pipe or fittings shall be used. Such inspection by the Architect shall not relieve the Contractor of full responsibility for the material installed.

G. Provide two bronze wedges per joint.

H. Pipe and fittings shall be as manufactured by Atlantic States Pipe Co., U.S. Pipe Co. or accepted substitution.

I. Mechanical Joint Retaining Glands – EBBA Iron Megalug or accepted substitution.

2.2 PIPING 2-INCH AND SMALLER

A. Polyethylene Tubing, copper tube size (CTS) , AWWA C901, 200 psi pressure class.

B. Couplings, corporation stops, curb stops, and caps: Compression ends; Mueller, Ford or approved equal. Comply with requirements of the New Britain Water Department. Comply with AWWA C800. Provide stiffener tubes for connections to plastic tubing. Provide stop and drain curb stops where indicated.

C. Curb boxes shall be iron body with close fitting, dirt tight covers. The top of the cover shall be flush with the box rim with the word "WATER" clearly marked.
   1. Curb boxes for 1 inch and 1-1/4 inch curb valves must be of the Buffalo Screw Type with 3 inch diameter shaft. Whenever a curb box is exposed to vehicular traffic, it must be of the Roadway Type.
   2. Curb boxes for 1-1/2 inch through 2-1/2 inch curb valves should be of the Roadway Screw Type with 4-1/4 inch diameter shaft.

2.3 GATE VALVES

A. All gate valves shall be AWWA C509 resilient seat, mechanical joint connections, fusion epoxy coated (AWWA C550). Valves shall open right (clockwise). Metroseal 250 by U.S. Pipe or accepted substitution.

B. All gate boxes shall be five (5) feet, cast-iron, two piece, slide top-flange top complete, six (6) inch diameter, bell bottom only, top marked with the word "WATER".

2.4 TAPPING SLEEVES AND VALVES

A. Tapping sleeves shall be cast iron or ductile iron with seals suitable for the pipe material being tapped and shall be as manufactured by Mueller, Kennedy, American Valve and Hydrant, M & H Valve Company, or equal.

B. Tapping valves shall be a gate valve with one flanged end for bolting to the tapping sleeve and one mechanical joint end. Working pressure shall be 200 p.s.i., minimum. Tapping valves shall conform to ANSI/AWWA C509 as amended to date, and shall be as manufactured by U.S. Pipe, Mueller, Kennedy, American Valve & Hydrant, M & H Valve Company, or equal.

C. Tapping valves shall open right (clockwise) and be furnished with a valve box as specified for gate valves above.

2.5 MAGNETIC WARNING TAPE

A. As shown on the Drawings and in accordance with Section 312000.

2.6 THRUST BLOCKS

A. Cast-in-place concrete as shown on the Drawings and in accordance with Division 3.

2.7 BEDDING AND BACKFILL

A. As shown on the Drawings and in accordance with Section 312333.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all underground pipe and fittings in accordance with the requirements of AWWA C600 except as otherwise provided herein. Excavate and shape the trench to conform to the details shown on the Drawings and as specified in Section 312333. No walking on or working over the pipes after they are laid, except as may be necessary in making joints and in tamping the backfill material, will be permitted until the pipes are covered to a depth of twelve (12) inches. During construction, protect all openings to the pipe lines from the entrance of earth or other material. Seal open ends of pipes when completed with watertight plugs. Where new pipes are to join existing ones, do all work necessary to make the connections, unless otherwise shown on the Drawings or specified.

B. Join all mechanical joint pipe and fittings in accordance with the requirements of Section 3.4 of the AWWA Standard C600. All mechanical joints shall have retaining glands installed in accordance with manufacturer's written instructions.

C. Carefully inspect pipes and fittings just before being laid or installed. Take every care in handling and laying pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces, and abrasion of the pipe coating or lining. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the Work. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack.

D. All ductile iron pipe, pipe joints at tees, bends greater than 11-1/4 degrees, and at hydrants shall be restrained using concrete thrust blocks and thrust restraining mechanical joint glands.

E. Valves - all materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms operated to check their proper functioning; and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.

F. Valve boxes shall be set centered and plumb over the operating nuts of all valves. Top of box installed flush with proposed grade unless otherwise directed by the Architect.

G. Tapping Sleeves and valves - Excavate main prior to ordering tapping sleeve and verify size and material of the main to be tapped. Install in accordance with manufacturer's instructions. Pressure test sleeves prior to initiating tap of main.

H. Install service connections as shown on the Drawings or as directed by the Engineer. Comply with AWWA C-600.

I. Tubing between corporation stops and curb stops shall be one piece without joints.

3.2 MAGNETIC WARNING TAPE

A. Install magnetic warning tape over underground piping as shown on the Drawings.

3.3 TESTING

A. Notify the Architect at least 48 hours in advance of a scheduled test so that the test may be witnessed.

B. Check and plug all relevant open ends, adequately block all bends, tees, and other fittings, and do whatever else is necessary so that pipelines will safely withstand the pressure developed under the tests and so that no damage or injury will occur to the pipeline, people or property.

C. All regulators, gages, traps, and other apparatus or equipment which may be damaged by test pressures shall be isolated or removed before tests are made.

D. Provide temporary blowoffs for flushing and air removal.

E. Should any test disclose leakage or pressure drop greater than that specified, the Contractor shall, at his own expense, locate and repair the defective joints until the specified allowance is met.

F. Testing shall be done in accordance with AWWA C600. After the trench has been backfilled, the test connections made, and the main filled with water, the test sections shall be subjected to water pressure normal to the area. After examination of the system, the test pressure shall be increased for the pressure test to 200 psi based on the lowest point in the line corrected to the elevation of the test gage as examined. If defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The Contractor will then repeat the pressure test until no defects are found. The duration of the final pressure test shall be at least 2 hours. The pressure shall not vary by more than plus/minus 5 psi.

G. A leakage test shall be conducted concurrently with the pressure test. The Contractor shall furnish the pump, pipe, gage, measuring device, connections, and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

H. Allowable leakage shall be equal to or less than that given in the table below (Reference AWWA C600, Table 6).

ALLOWABLE LEAKAGE PER 1,000 FT. OF PIPELINE

Ave. Test Pressure psi	Gallons per Hour Nominal Pipe Diameter - Inches ≤ 3	4	6	8	10	12	14	16	18	20	24
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21

If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the leakage for each size.

3.4 DISINFECTION

A. Flush and disinfect all waterlines which are installed or which are broken into, repaired or replaced. Disinfection shall be in conformance with AWWA C651. Use continuous feed method.

B. Prior to flushing chlorine from waterlines, sample and record chlorine residual upstream of the installed waterlines for background chlorine levels.

C. Collect and treat heavily chlorinated water for removal of chlorine prior to discharge. Obtain permits necessary to discharge.

D. Submit results of bacteriologic testing to the Architect.

END OF SECTION 331000

SECTION 333999 - EXTERIOR SANITARY SEWER SYSTEM

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. Underground gravity sanitary sewer pipe and fittings to within five (5) feet of building foundations.
2. Manholes.
3. Magnetic warning tape.
4. Coordination with the utility having jurisdiction (New Britain Sewer Department).
5. Testing.

B. Related Requirements:
1. Division 3 - Concrete
2. Division 22 - Plumbing: Piping within buildings to five (5) feet outside of buildings.
3. Section 312000 - Earth Moving
4. Section 312333 - Trenching

1.3 QUALITY OF WORK

A. Provide at least one (1) person who shall be present at all times during the execution of this portion of the Work, and who shall be thoroughly familiar with the types of materials being installed, pipe loadings, and the material manufacturer's recommended methods of installation, and who shall direct all work performed under this Section.

B. Pipe installation shall be done by skilled workers. Each pipe laying crew shall have a pipe laying foreman.

C. All precast concrete sanitary structure components shall be the product of a single manufacturer. Likewise, all frames and grates shall be the product of a single manufacturer

D. Comply with the requirements and standards of the New Britain Sewer Department.

1.4 SUBMITTALS

A. Shop drawings, catalog cuts, design details, manufacturer's literature and technical data for all products and materials appurtenant to the construction specified herein.

B. Video tape with annotated video and duplicate hardcopy annotation document of all completed and accepted pipe runs.

1.5 COORDINATION AND SCHEDULING

A. Coordinate timely inspection of sanitary sewer system by the New Britain Sewer Department prior to backfilling, with the New Britain Sewer Department, Owner and Architect, so as not to delay the progress of the work. All fees by the New Britain Sewer Department shall be paid by the Owner directly.

1.6 SOURCE QUALITY CONTROL

A. For precast concrete, perform tests to ensure compliance with ASTM C478 and these Specifications.

1.7 DELIVERY, STORAGE AND HANDLING

A. Carefully handle all materials when loading and unloading. Lift by hoists or lower on skidways in a manner to avoid shock.

B. Use derricks, ropes or other suitable equipment for lowering materials where required due to weight of material and for the safety and protection of workmen, materials, equipment, property and the Work.

C. Handle and store all materials so as to preclude damage. Plastic pipe and fittings shall be protected against the damaging ultraviolet rays of the sun when stored for periods in excess of six months. Such protection shall consist of canvas covering or other material as recommended by the manufacturer. Plastic sheets shall not be used for protective covering, nor shall any material be used for protective covering which may allow excessive temperatures to develop. All pipe which has been distorted or otherwise negatively affected by high temperatures shall be rejected.

D. Deliver cement, lime, and all waterproofing and similar materials in manufacturer's unopened and clearly marked containers. Store in weather-proof enclosures.

1.8 PROTECTION

A. Be solely responsible for construction methods, means, techniques and for construction site safety precautions. Conduct construction operations in conformance with all applicable local, state and Federal safety laws, rules, regulations and codes.

PART 2 - PRODUCTS

2.1 GRAVITY SEWER PIPE- 15" DIAMETER AND SMALLER

A. PVC Pipe

1. Pipe shall conform to ASTM D3034, SDR35 as manufactured by Johns Manville, Certainteed, Clow or accepted substitution, except where otherwise indicated.
2. Stiffness - 46 psi minimum at 5 percent deflection as per ASTM D2412.
3. Standard Laying Length – twenty (20) feet. Laying lengths of twelve and one-half (12 1/2) feet and random lengths of lesser or intermediate length may be utilized, subject to the conditions outlined in Paragraph 3.2 of this Section.
4. Joints - integral wall bell and spigot type with a solid cross-section rubber ring, factory assembled, and securely locked in place to prevent displacement during assembly. Each spigot end shall be clearly marked for the entire circumference, indicating the proper distance of insertion into the adjoining bell end, such marking being placed so as to adequately allow for expansion and contraction of the pipeline over the full range of temperature fluctuations which may occur in the final installation. The rubber sealing ring gasket shall permit the pipe to expand, contract and deflect, maintaining an adequate compressive force against the sealing surfaces so as to effect a continuous and positive seal under all conditions of the joint tolerances, and shall meet the requirements of ASTM F477. The sealing ring shall be the only element depended on to make the joint flexible and watertight.
5. Joint Lubricant - as recommended by the manufacturer.
6. Fittings - identical manufacture as the pipe with respect to strength, material, physical properties, joints and all other pertinent criteria.

B. Pressure Pipe - Schedule 80 PVC
1. Where indicated provide schedule 80 PVC pipe with solvent welded joints.
2. Pipe and fittings - Manufactured from a polyvinyl chloride compound conforming to the requirements of PVC 1120 (Type I, Grade I) cell classification 12454B, as specified in ASTM D1784.
3. Pipe: Conform to requirements of ASTM D1785, Schedule 80. Tested and approved for carrying potable water by the National Sanitation Foundation. Homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles and dents, and clearly marked in conformance with ASTM D1785.
4. Fittings: Conform to the requirements of ASTM D2464, D2466 and D2467. All fittings shall be of the solvent welded socket joint type, or solvent welded socket type flanged joints with gaskets of suitable composition for the intended service as shown on the Drawings or as approved by Engineer. Unions shall be of the True Union type. Provide special transition fittings where it is required to join PVC pipe with screwed or flanged metal pipes. Screwed type fittings will not be permitted. Bolts, nuts and washers shall be of Series 300 Stainless Steel. All fittings shall be clearly marked in conformance with ASTM D2466.
5. Primers and cements for solvent cement joints: Conform to the requirements of ASTM F656 for primers and ASTM D2564 for cements.

2.2 MANHOLES

A. Precast concrete - comply with ASTM C478.

B. Joints - seal all manhole joints with a neoprene rubber O-ring, or with a self-sealant butyl based rubber gasket conforming to ASTM C443 and AASHTO M 198.

C. Pipe connections.
1. To new sanitary sewer manholes - integral rubber boot.

2. To existing sanitary sewer manhole - resilient rubber boot "Res-Seal" by Scale Manufacturing Corp., "Press Wedge II" by Press-Seal Gasket Corp., "Kore-n-Seal", or accepted substitution.

D. Rungs (steps) – in conformance with ASTM C478 and shall be of copolymer polypropylene conforming to ASTM D4101 for Type II propylene copolymers. The copolymer polypropylene shall encase a 1/2 inch diameter grade 60 reinforcing bar conforming to ASTM A615.

E. Risers.
1. Precast concrete grade rings. Equal in materials and construction to that specified for manholes. Laid in mortar.
2. Concrete brick - ASTM C55, Grade S II, laid in mortar.
3. Clay brick - ASTM C32, Grade SS, laid in mortar.
4. Masonry Concrete Units - ASTM C139, laid in mortar.
5. Mortar materials.
6. Portland cement - ASTM C150 Type II.
7. Sand - ASTM C33, fine concrete aggregate.
8. Hydrated lime - ASTM C207, Type S.
9. Mortar mix - one (1) part of Portland cement to two (2) parts of sand, with lime at the rate of ten (10) lbs. per bag of cement.
10. Concrete - comply with Division 3.

F. Frames and covers - Manufacturer model numbers are indicated on the Drawings. Acceptable manufacturers are Neenah, Campbell, Flockhart or accepted substitution. Covers shall include the cast-in inscription “SANITARY”, and any numeric designation that may be required by the Drawings.

G. Waterproofing - one-component coal tar pitch coating, "Super-service Black" by Koppers, "Duralkote 332" by Dural International Corp., "Coating No. 103" by Pittsburgh Coke and Chemical Co., "Intertol Standard" by Automatic Coating, Inc., or accepted substitution.

2.3 FLEXIBLE COUPLING

A. Coupling - Fernco, Inc. Series and Part Number according to pipe material(s) and size(s), or accepted substitution.

B. Shear Ring - stainless steel shear ring as manufactured by Fernco, Inc., or accepted substitution.

2.4 MAGNETIC WARNING TAPE

A. As shown on the Drawings and in accordance with Section 312000.

2.5 BEDDING AND BACKFILL

A. As shown on the Drawings and in accordance with Section 312333.

2.6 GEOTEXTILE

A. As shown on the Drawings and in accordance with Section 312333.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify that trench conditions and pipe bedding are properly provided in accordance with the Drawings and Specifications.

B. Reinspect each length of pipe, fittings and joints prior to lowering it into the trench. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by the Architect, may be cut off by and at the expense of the Contractor before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least twelve (12) inches from the visible limits of the crack.

C. Do not install pipe until conditions are satisfactory.

D. Install piping in accordance with manufacturer's instructions and as specified herein.

E. Carefully inspect pipes and fittings just before being laid or installed. Take every care in handling and laying pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces, and abrasion of the pipe coating or lining. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, must be marked as rejected and removed at once from the Work.

F. Thoroughly clean pipe and fitting interiors, joint surfaces and gaskets prior to installation. Maintain pipes and fittings clean.

G. Carefully lower pipes and fittings into the trench. Apply the approved manufacturer's joint lubricant in accordance with his recommendations. Join pipe sections and fittings.

H. Install pipes in the locations and to the required lines and grades, using an approved method of control.

I. Maintain the excavation free of water during the progress of the Work. No pipes shall be laid in water nor shall there be any joints made up in water. All slides or cave-ins of the trenches or cuts shall be remedied at the expense of the Contractor, and to the satisfaction of the Architect.

J. Maintain cleanliness of installed pipe and fitting interiors throughout the Work. Plug ends with approved pipe fittings when pipe installation is not in progress. Drainage of construction excavation through sanitary sewers is prohibited.

K. Make connections between pipes of different materials with approved adapters. The encasement of such connections with concrete is prohibited.

L. Commence gravity pipe laying at the lowest point, with the spigot ends pointing in the direction of flow.

M. All adjustments to the line and grade of pipe laid on earth foundation shall be done by scraping away or filling in the earth under the barrel of the pipe, and not by blocking or wedging.

N. Join sections of pipe by hand only, without the use of levers or other mechanical aids. Both the sealing gasket and the adjoining spigot end shall be thoroughly cleaned and coated with lubricant. The spigot end shall be placed in the bell end only as far as the reference mark provided on each spigot end, to allow for expansion, contraction, and deflection, and not "pushed home".

O. No walking on or working over the pipes after they are laid, except as may be necessary in making joints, and in tamping the backfill material will be permitted until the pipes are covered to a depth of twelve (12) inches. During construction, protect all openings to the pipe lines from the entrance of earth or other materials. Seal open ends of branches and pipes when completed with stoppers or equally effective methods.

P. The open ends of all pipe stubs or lines installed for future connections shall be plugged and sealed watertight as directed.

Q. The piping work shall be of such character as to leave all the pipes and connections watertight.

R. Flush all completed piping, then televise all completed piping. Correct any deficiencies such as pipe sags by re-excavating and re-laying unacceptable pipe lengths, to the satisfaction of the Architect.

3.2 GRAVITY SEWER PIPE

A. Install piping in accordance with manufacturer's instructions and as specified herein.

B. Join sections of pipe by hand only, without the use of levers or other mechanical aids. The spigot end shall be placed in the bell end only as far as the reference mark provided on each spigot end, to allow for expansion, contraction, and deflection, and not "pushed home".

C. Pipe lengths of twenty (20) feet shall be utilized, except that shorter lengths of twelve and one-half (12 1/2) feet, or random lengths, may be utilized where connections, tees, and similar circumstances are present, only inasmuch as is necessary to properly effect the joint(s) in the desired location. In all cases, the number of pipe joints shall be minimized. In the case of random lengths of pipe, provide proper reference marks on spigot ends prior to assembling.

D. Perform field cutting of pipe with use of a fine-toothed hacksaw, a handsaw, or a circular saw, each of which shall be used in connection with a fabricated jig or miter box to ensure a perfectly square cut. After cutting, the cut end shall be cleaned of any burrs to match that of a factory finished pipe end.

E. No walking on or working over the pipes after they are laid, except as may be necessary in making joints, and in tamping the backfill material will be permitted until the pipes are covered to a depth of twelve (12) inches. During construction, protect all openings to the pipe lines

from the entrance of earth or other materials. Seal open ends of branches and pipes when completed with stoppers or equally effective methods.

F. Accurately install pipe to the lines and grades shown on the Drawings so that inverts are smooth and straight. Deflections of joints are not permitted.

3.3 MAGNETIC WARNING TAPE

A. Install magnetic warning tape over all underground piping as shown on the Drawings.

3.4 MANHOLES

A. Verify that all pipes have been laid in their correct location, and that excavation and subgrade preparation is properly completed.

B. Precast bases - place precast bases carefully and accurately, level and plumb, on a bed of select fill material of the type and thickness shown on the Drawings, to meet the lines, grades, and elevations shown on the Drawings.

C. Connecting pipes and stubs to new sanitary manholes - Connect pipe and stub sections to the inlet and outlet provisions in the base section. Fasten rubber boot as applicable to provide a flexible and watertight joint. Provide a pipe joint within 12 inches - 18 inches of the manhole wall. Plug unused stubs with plugs of approved design, specially manufactured for such use by the pipe manufacturer.

D. Connecting pipes and stubs to existing sanitary manholes - Accurately core manhole base section side wall for inlet and outlet provisions, both vertically and circumferentially, to guarantee compliance with the lines and grades shown on the Drawings or ordered by the Architect. Install resilient rubber boot in accordance with manufacturer's recommendations, to provide a flexible and watertight joint. Cutting and patching to achieve proper line and grade is prohibited. Provide a pipe joint within 12 inches - 18 inches of the manhole wall. Plug unused stubs with plugs of approved design, specially manufactured for such use by the pipe manufacturer. Modify the manhole invert as required for the new pipe connection, as specified herein for new construction.

E. Risers and top sections - install risers and top sections in proper alignment, to produce straight vertical alignment of the rungs (steps) over the largest bench area and directly beneath the cover. Thoroughly clean each joint and make up joint in accordance with manufacturer's recommendations. If damage occurs to riser, base, or top sections, as a result of improper alignment during setting, and subsequent attempts at realignment, said sections shall be rejected. Accordingly, proceed with caution during alignment and setting operations.

F. Filling joints - parge interior and exterior riser joints with mortar.

G. Pointing up - point up all concrete surfaces to provide a clean finished installation.

H. Waterproofing – coat all manhole exterior buried surfaces with waterproofing, except where in contact with masonry units. Factory apply or field apply as applicable. Touch up in field as required.

I. Inverts and benches - construct inverts and benches as shown on the Drawings to produce smooth, non-turbulent flow. The bottom half of the invert shall be a smooth semicircle, which shall extend vertically from the pipe spring line to an elevation equal to the crown of the highest pipe in the manhole. The bench area shall extend from the top of the highest pipe to the wall at a slope of 1/2 inch per foot or as otherwise shown on the Drawings. Form all inverts of the maximum possible horizontal radius tangent to the centerlines of the incoming and outgoing pipes.

J. Frames and Covers - set frames and covers on a mortar bed of 1/2 inch minimum thickness.

3.5 CLEANING

A. Upon completion of construction, remove all dirt and other foreign material from the pipelines and their appurtenant construction. No material shall be left in pipelines to impede the normal flow through them. The last fitting or closing piece for any run of pipe shall not be installed until that run has been thoroughly flushed with clear water.

3.6 TELEVISING

A. Televise all completed piping runs after flushing in the presence of the Architect. Submit two copies of DVD of televised run. Correct any deficiencies such as pipe sags by re-excavating and re-laying unacceptable pipe lengths, to the satisfaction of the Architect.

3.7 TESTING

A. General
   1. Conform to Division 1.
   2. Properly support the piping and appurtenances during testing to prevent damage to piping, appurtenances, hangers and supports. Disconnect pressure switches, pressure gages and other instruments that are susceptible to pressure damage during the test.
   3. Provide all necessary temporary bracing, supports, blocking, clamps and restraint rods as may be required to hold pipes, fittings and valves in place during testing to withstand the internal test pressures.
   4. Locate and eliminate all visual leakage in pipelines. Make repairs in a first-class workmanlike manner. All work found to possess leaks may be ordered to be re-excavated, removed and replaced. In all cases, make repairs or replacement with the prior concurrence of the Architect. Then repeat testing procedures.
   5. Should any test disclose leakage greater than that specified, locate and repair the defective joints at no cost to the Owner until the specified allowance is met.

B. Gravity Sewer Pipe
   1. Infiltration - No visible infiltration.
   2. Exfiltration - All piping to be subjected to exfiltration testing. Exfiltration testing to be performed as follows:
      a. Low Pressure Air Testing - when the piping is subject to a low pressure air test, immediately prior to the testing, clean the pipe by propelling a snug-fitting inflated ball with water behind it. Remove debris as required. Cap and brace all plugs, wyes, tees and ends of stubs to withstand the internal test pressures.

b. After the piping has been cleaned, plug the pipes at each tank, chamber or open end with pneumatic balls and apply low pressure air through one of the balls to the pipe until the internal air pressure in the pipe reaches 4.0 pounds per square inch greater than the average pressure of groundwater that may submerge the pipe.
c. Provide the air compressor with an 8.0 psig pressure relief valve. Maintain the 4.0 psig for a period of two minutes minimum. After two minutes, allow the pressure to drop in the pipe to 3.5 psig and disconnect the air supply. Measure the time in minutes and seconds for the pressure to decrease from 3.5 psig to 3.0 psig.
d. The low pressure air test requirement will be satisfied if the time required for the pressure to decrease from 3.5 to 3.0 psig (greater than the average back pressure of groundwater that may submerge the pipe) for each reach of the pipe is not less than 3 minutes 46 seconds for four (4) inch diameter pipe, 5 minutes 40 seconds for six (6) inch diameter pipe, 7 minutes 34 seconds for eight (8) inch diameter pipe, 11minutes 20 seconds for twelve (12) inch diameter pipe, 14 minutes 10 seconds for fifteen (15) inch diameter pipe, and 17 minutes 0 seconds for eighteen (18) inch diameter pipe

3. Deflection - perform deflection test on all sewers. No pipe shall have a deflection in excess of five (5) percent of the inside diameter. Conduct deflection test using a rigid ball or mandrel with a diameter equal to ninety-five (95) percent of the inside diameter of the pipe. Perform tests without using mechanical pulling devices. Remove and replace all sections of pipe that do not pass the test ball or mandrel.

C. Manholes

1. All visual leakage and infiltration in manholes shall be located and eliminated. Repairs shall be made in a first-class workmanlike manner, and all work found to possess leaks may be ordered to be re-excavated, removed and replaced. In all cases, repair or replacement shall be with the prior concurrence of the Architect. The testing procedure(s) shall then be repeated.
2. Should any test disclose leakage or infiltration greater than that specified, the Contractor shall at his own expense locate and repair the defective joints until the specified allowance is met.
3. All manholes shall be tested after all pipe connections have been made and after all backfill has been placed.
4. Infiltration - no infiltration shall be evident in any manhole. Manholes shall be visually checked after completion of backfilling.
5. Exfiltration - manholes shall be tested by vacuum as follows:
   a. Plug all lift holes with an approved non-shrink grout.
   b. Plug all pipes entering manhole, taking care to securely brace the plug from being drawn into the manhole.
   c. The test head shall be placed at the inside of the top of the top section and the seal inflated in accordance with the manufacturer's recommendations.
   d. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48" diameter, 75 seconds for 60" diameter, and 90 seconds for 72" diameter manholes.

3.8 CORRECTION OF LEAKAGE

A. Leakage rates in excess of those specified above will not be accepted. Whether or not a test indicates a rate less than the allowable, stop all visible leaks in a manner acceptable to Architect.

B. Correct all defects in pipes not passing the tests to the satisfaction of Architect, and re-correct, re-televise and re-test as often as is necessary until the test requirements have been met.

C. It is the intent of this Project to obtain work meeting test requirements on its own merit and solely through the use of the normal integral sealing components. Stopping of joint leaks through the use of concrete, caulking, mortar or other patching materials is not allowed. Rejoin all leaking joints.

D. Do not use methods other than rejoining or resetting without written approval of Architect.

END OF SECTION 333000

SECTION 334000 - STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Form 817-2016 shall mean the State of Connecticut, Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 817-2016 or its latest edition and any supplemental specifications.

1.2 SUMMARY

A. This Section includes:
1. Catch basins.
2. Storm manholes.
3. Lawn inlets.
4. Rain garden drains.
5. Trench drains.
6. Storm drainage pipe, fittings and appurtenances.
7. Riprap for splash pad.

B. Related Sections include the following:
1. Section 033000 - Cast-in-Place Concrete
2. Section 312000 - Earth Moving
3. Section 312333 - Trenching
4. Section 312500 - Soil Erosion and Sediment Control
5. Section 315000 - Sheeting and Bracing
6. Section 334416 - Trench Drain and Grate

1.3 REFERENCE STANDARDS

A. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Pipe.

B. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.

C. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

D. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale).

E. ASTM C55 - Standard Specification for Concrete Building Brick.

F. ASTM C139 - Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

G. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

H. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.

I. ASTM D4101 - Standard Specification for Polypropylene Injection and Extrusion Materials.

1.4 SUBMITTALS

A. Shop Drawings - Submit catalog cuts, manufacturer's literature, and technical data for approval showing products and materials proposed for:
   1. Precast concrete catch basins and manholes.
   2. Catch basin frames and grates.
   3. Manhole frames and covers.
   4. All pipe, end sections, and fittings.

1.5 QUALITY ASSURANCE

A. Comply with the requirements of the authority having jurisdiction for work involving restoration of their storm drainage systems.

B. Furnish and install all drainage systems in accordance with the details shown on the Drawings.

C. All precast concrete drainage structure components shall be the product of a single manufacturer. Likewise, all frames and grates shall be the product of a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle all materials so as to preclude all damage thereto.

B. Deliver cement, lime, and all waterproofing and similar materials in manufacturer's unopened and clearly marked containers. Store in weather-proof enclosures.

C. SOURCE QUALITY CONTROL

D. For precast concrete, perform tests to ensure compliance with ASTM C478 and these Specifications.

PART 2 - PRODUCTS

2.1 STORM DRAINAGE STRUCTURES

A. PRECAST CONCRETE CATCH BASINS
   1. Conform to Section 5.07 of the Form 817-2016.
   2. Catch Basins - Conform to Section M.08, Article M.08.02-4 of the Form 817-2016.

3. Catch Basin Frame and Grates - Conform to Section M.08, Article M.08.02-5 of the Form 817-2016. Type as shown on the drawings with a Galvanized Type A Grate.

B. PRECAST CONCRETE MANHOLES
1. Conform to Section 5.07 of the Form 817-2016.
2. Precast Manhole Concrete Components - Conform to Section M.08, Article M.08.02-4 of the Form 817-2016.
3. Joints - Seal all manhole joints with a neoprene rubber O-ring, or with a self-sealant butyl based rubber gasket conforming to ASTM C443 and AASHTO M198.
4. Pipe connections - Mortar inside and outside joint.
5. Rungs (steps) - Conformance with ASTM C478 and shall be of copolymer polypropylene conforming to ASTM D4101 for Type II propylene copolymers. The copolymer polypropylene shall encase a 1/2 inch diameter grade 60 reinforcing bar conforming to ASTM A615.
6. Risers.
    a. Precast grade rings. Equal in materials and construction to that specified for manholes. Laid in mortar.
    b. Concrete brick - ASTM C55, Grade S II, laid in mortar.
    c. Clay brick - ASTM C32, Grade SS, laid in mortar.
    d. Masonry Concrete Units - ASTM C139, laid in mortar.
    e. Mortar materials.
        1) Portland cement - ASTM C150 Type II.
        2) Sand - ASTM C33, fine concrete aggregate.
        3) Hydrated lime - ASTM C207, Type S.
    f. Mortar mix - One (1) part of Portland cement to two (2) parts of sand, with lime at the rate of ten (10) lbs. per bag of cement.
    g. Concrete - Concrete shall be Class “A” as specified in Section M.03.01 of the Form 817-2016 and amended as follows:
        1) The mix proportion shall be 1:2:4.
        2) The maximum size of the coarse aggregate shall be 3/4”.
        3) Minimum compressive strength shall be 3,000 psi at 28 days.
7. Manhole Frames and Covers conform to Section 5.07, Article 5.07.02 of the Standard Specifications. Type as shown on the drawings and as manufactured by Campbell Foundry Company or accepted substitution.

C. LAWN INLETS
1. PVC body and riser sections with outlet adapter for size and type of piping as shown on the drawings. Cast iron pedestrian grate of size as shown on the drawings with grate opening sizes conforming to American With Disabilities Act requirements. Provide PVC gasketed plug for unused openings in outlet adapter. Product Engineered Surface Drainage Products as manufactured by Nyloplast, or approved equal.

D. RAIN GARDEN DRAINS
1. PVC body and riser sections with outlet adapter for size and type of piping as shown on the drawings. Cast iron dome grate of size as shown on the drawings. Provide PVC gasketed plug for unused openings in outlet adapter. Product Engineered Surface Drainage Products as manufactured by Nyloplast, or approved equal.

E. TRENCH DRAINS
1. Polycast 600 system - Comply with Specification 334416.

2.2 STORM DRAINAGE PIPE

A. Corrugated polyethylene tubing and fittings.
   1. Tubing and Fittings, 4 inch diameter to 10 inch diameter - AASHTO M252 Type S (solid wall with smooth interior) or Type SP (solid wall with smooth interior and perforations) as indicated on the Drawings, as manufactured by Advanced Drainage Systems, Inc., Hancor, or accepted substitution.
   2. Couplings - Split coupler, high molecular weight, high density polyethylene conforming to ASTM D1248, as manufactured by Advanced Drainage Systems, Inc., Hancor, or accepted substitution.

B. Corrugated polyethylene pipe and fittings
   1. Pipe and Fittings, 12 inch diameter to 24 inch diameter - AASHTO M294 Type S (solid wall with smooth interior) or Type SP (solid wall with smooth interior and Class 1 perforations) as indicated on the Drawings, as manufactured by Advanced Drainage Systems, Inc., Hancor, or accepted substitution.
   2. End Sections and Couplings - Soil tight unless otherwise shown on Drawings, high molecular weight, high density polyethylene meeting or exceeding ASTM F2306, as manufactured by Advanced Drainage Systems, Inc. or accepted substitution.

2.3 CAST-IN-PLACE CONCRETE ENDWALL

A. Comply with Section 5.06 of Form 817-2016.

2.4 SELECT FILL AND BEDDING MATERIALS

A. Pipe Bedding - Comply with Section 312333.

B. Granular Fill - Comply with Section 312000.

C. 3/8” Crushed Stone - Comply with Section 312000.

2.5 GEOTEXTILE

A. Nonwoven Geotextile - Comply with Section 312000.

2.6 RIPRAP

A. Shall consist of sound, tough, durable, and angular rock, free from decomposed stones or other defects impairing durability. The size of a stone as hereinafter specified shall be its least dimension. Broken concrete or rounded stones are not acceptable. The riprap designation as noted on the Drawings shall comply with the following gradation:
   1. Modified Rip Rap:

Stone Size	Percent of the weight
10”	0
6” - 10”	20-50
4” - 6”	30-60
2” - 4”	30-40
1” - 2”	10-20
<1”	0-10

Source: Standard Specifications, July 2015, Article M.12.02, Modified Riprap

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. Install level, plumb and on select fill base materials. Comply with Section 312323.

B. Take precautions to protect existing storm drainage systems and their earth foundations and bedding. Replace in kind and size any storm drainage system components damaged or displaced during installation of the Work.

C. Conform to Section 5.07, Article 5.07.03 of the Form 817-2016 for construction methods for catch basins, storm manholes, lawn inlets, rain garden drains, and trench drains.

D. On precast units the tops shall be set on a minimum of two (2) courses of brick, so that the casting can be adjusted in the future without disturbing the precast sections.

E. Pointing up - Point up all concrete surfaces to provide a clean finished installation.

F. Conform to Section 5.06, Article 5.06.03-2 for construction methods for endwalls.

G. Conform to Section 6.51, Article 6.51.03 of the Form 817-2016 for construction methods for storm drains, and underdrains.

H. Verify that all pipes have been laid in the correct location, and that excavation and subgrade preparation is properly complete.

I. Inspect all pipe before laying. Reject and remove pipe not meeting Specifications.

J. Backfill in accordance with Section 312333 to twelve (12) inches above the top of the proposed pipe elevation for pipes laid above existing grade prior to excavating trench.

K. Excavate trenches in accordance with Section 312333.

L. Install pipes in accordance with the details and to the required lines and grades as shown on the Drawings using an approved method of control. Adjustments to line and grade shall be done by scraping away or filling under pipe, not by blocking or wedging.

M. Backfill trenches in accordance with Section 312333. Compact fill material around pipe when fill material reaches a six (6) inches in depth from pipe invert in addition to the requirements set forth in Section 312333.

N. Where indicated on the Drawings or directed by the Engineer, take up and relay or extend and renew existing pipe culverts in the same manner as specified herein for new pipe culverts.

O. Where shown on the Drawings or directed by the Engineer, connect the proposed drainage system with existing drainage structures or pipes in a workmanlike manner.

P. Where shown on the Drawings or directed by the Engineer, plug existing pipes with cement masonry.

Q. Riprap
1. Place riprap in the locations, lines and grades, and to the thicknesses shown on the Drawings or as directed by the Engineer.
2. Accurately shape the area to be protected by riprap prior to placing of any bedding material or riprap.
3. Place geotextile on surface and sides of area shaped for riprap. Stake as required to hold geotextile fabric in place for backfilling.
4. Where bedding material is called for, it shall be placed on the prepared area and compacted to the depth, lines, and grades indicated on the Drawings.
5. Place riprap to its full course thickness in one operation to produce a well-graded mass of rock without causing displacement or damage of the underlying material.
6. The finished surface shall be free from pockets of small stones and clusters of large stones. Placing of material by methods likely to cause segregation of the various sizes of stone will not be permitted. Rearrange individual stones mechanically or by hand to obtain a well-graded distribution of stone sizes.

END OF SECTION 334000

SECTION 334416 – TRENCH DRAIN AND GRATE

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. Provision of precast, presloped polymer concrete drain system including accessories necessary to install system.

1.3 QUALITY ASSURANCE

A. The manufacturer of Trench Drain to have minimum five years of successful installations of projects similar in scope to this project.

B. Fabricator to be experienced in successfully producing custom polymer concrete drainage fabrications similar to requirements of this project. Fabricator to have sufficient production capacity to not delay work of this section.

1.4 DESIGN REQUIREMENTS

A. Design load on drainage system is:
Load Class C: Pneumatic Tire Vehicles and Highway Vehicles, Low Speeds (parking areas, driveways).

B. Design hydraulic flow at trench connection to outflow pipe to be 360 gal per minute.

1.5 SUBMITTALS

A. Submit manufacturer's shop drawings indicating layout of trench system with part numbers. Include plans, elevations, sections and details. Indicate accessories' part number and locations. Indicate manufacturer's recommended tolerances. Detail fabrication and erection. Detail connections, anchorage and accessory items.

B. Manufacturer's catalog data showing:
1. Product materials, dimensions of relevant components, chemical resistance guide, and installation guide.
2. Specifically indicate compliance with Design Requirements article and Physical Properties article.

C. Submit samples of trench system and components representative of materials and finished products.

D. Provide flow calculations that demonstrate that the system meets the project requirements.

1.6 SHIPPING AND STORAGE

A. Ship with all necessary hardware securely fastened to the channels or shipping pallet.

B. Do not stack loaded pallets of polymer concrete drain systems.

C. Components and accessories to be identified and keyed to layout shop drawing.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer to be equivalent to Hubbell Polycast, Product to be equivalent to POLYCAST® 400 Series Pre-sloped Drain for general light traffic commercial applications in 24' or 48" modular sections.

B. Entire system of trench components and accessories to be obtained from a single source.

2.2 TRENCH CHANNEL MATERIAL

A. Use first run product of the best quality and suitable for the purpose intended. Product to be free of defects and imperfections that effect performance of installed system.

B. Trench drain channels to be precast polymer concrete utilizing vinyl ester resin.

C. Precast trench units with minimum average slope of 0.65%. Precast trench units with two foot or four foot lengths.

D. Provide horizontal anchoring ribs located along the bottom of the channel to mechanically engage into concrete. Anchoring rib to be minimum sixty (60) percent of channel length. Channel base to be four and three-eights inches (4-1/4") wide to provide maximum load distribution.

E. Every fifth sloped trench channel to have provision for vertical drain outside in four (4") and six (6") inch pipe.

2.3 TRENCH CHANNEL PHYSICAL PROPERTIES

DESCRIPTION	**TEST METHOD**	**VALUES**
Accelerated Service	ASTM D756-E	Retains 75% strength <2% change in weight or dimension
Chemical Corrosion	ASTM D543	Retains 75% strength <2% change in weight or dimension
Water Absorption	ASTM D570	<1%

A. No cracking, crazing, checking, blistering, or surface pitting is allowed. Changes in color acceptable when not indicative of physical degradation.

2.4 CHANNEL GRATE MATERIALS

A. Equip channels and catch basins with:

Fiberglass gratings fabricated from 1/4" x 3/4" pultruded fiberglass bars. Bar spacing shall be three-eighths (3/8") inch or less on centers to provide an intake cross section of 25.5 square inches per linear foot. Bar material to be vinyl ester resin, gray in color with anti-skid grit surface, suitable for bare foot traffic. Bar material to be vinyl ester resin, gray in color with anti-skid grit surface.

B. Manufacture grating to bear evenly on channel edges.

C. Provide non-metallic lock down bolts and bars.

D. Provide grating sections in lengths to match the channel sections. Grates to have a width of five and one-fourth (5-1/4") inches.

2.5 ACCESSORIES

A. Provide two (2) lock down mechanisms per four-foot section, one (1) per two-foot section. Provide lock down bolts with each channel and grate assembly. Lock down mechanism to withstand installation torque of twenty (20) ft. lbs.

B. Provide male and female end caps at termination of trench runs.

C. Make available and provide transition pieces for female to female connections and male to male connections when required.

D. Catch basins shall be precast vinyl ester polymer concrete POLYCAST® 651 with corrugated plastic trash buckets. Fully interlock trench drains entering catch basins with tongue and groove connections. Discharge pipe connections shall be 4".

E. Provide side-wall extensions of seven and thirteen-sixteenths (7-13/16") inches for extended channel runs while continuing the standard 0.65% slope.

PART 3 - EXECUTION

3.1 PREPARATION

A. Excavate trench for channel placement. Trench excavation to be minimum four (4") inches wider on both sides and four (4") inches deeper than polymer concrete channel cross section to accommodate bedding concrete.

3.2 INSTALLATION

A. Install in strict accordance with manufacturer’s to installation recommendations and approved shop drawings.

B. Use sealant to interlock adjoining trench surfaces. Comply with sealant manufacturer's recommended surface preparation techniques. Clean surplus sealant from interior trench surface and grate bearing areas.

C. Begin channel placement at deepest end usually at outflow pipe or catch basin. Place channels in numerical sequence with flow arrows correctly oriented.

D. Firmly anchor channels using manufacturer's chair support. Place one support chair at each end of trench channel. Bolt support chair on to preformed conical dimple on trench channel. Drive No. 4 rebar into subgrade at chair locations. Hang support chair on rebar. Adjust trench flush to Top of Slab (TOS). Elevation noted on plans.

   POLYCAST® support chair is unique and patented. The POLYCAST® chair is critical for alignment, mechanical interlock and to prevent channel floating during the placement of the concrete.

E. All metallic supports, anchors and components to be bonded and grounded, in accordance with THE National Electric Code (NEC) latest edition.

F. After finishing concrete, thoroughly clean channels and grates. Reinstall grates and secure with lock down devices to hold the gratings firmly in place.

END OF SECTION 334416