PROJECT MANUAL

TOWN OF GREENWICH
CONNECTICUT

SECURE ENTRANCE

EASTERN MIDDLE SCHOOL
51 HENDRIE AVENUE
GREENWICH, CT 06878

BID #2588-26
S/P+A PROJECT #24.179

VOLUME 1 OF 1

Issued for Bid: November 10, 2026

Architects | Engineers | Interiors
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311 State Street, New London, CT 06320

SECURE ENTRANCE

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RIVERSIDE, CT 06878
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GREENWICH PUBLIC SCHOOLS
Purchasing Department
290 Greenwich Avenue
Greenwich, Connecticut 06830
(203) 625-7411
eugene_watts@greenwich.k12.ct.us

EUGENE H. WATTS
Manager of School Procurement

November 10, 2026

Dear Sir/Madam:

You are invited to submit a bid for Greenwich Public Schools Eastern Middle School Secure Entrance for Greenwich Public School District. The attached bid specifications detail the requirements we are looking for.

Bidders are urged to read all documents carefully and fill out all information requested. Bids which are incomplete, obscure, or conditional, and which contain irregularities of any kind, will be subject to rejection for failure to comply strictly with these conditions.

Bids must be submitted on the schedule forms attached. All unit prices must be filled in and the cost sheet must be the first page of the submitted bid. Each bid must be submitted and clearly marked as (1) one original, (6) six copies and one (1) unprotected USB flash drive.

Bidders must submit bids in a clear, concise and legible manner to permit proper evaluation of responsive bid. Faxed, emailed and late bids will not be accepted however, hand delivered, mailed or overnight bids will be accepted Monday through Friday between the hours of 8:30am - 3:30pm at: Greenwich Public Schools 290 Greenwich Avenue Greenwich, CT 06831. The original bid and copies must be in a sealed envelope plainly marked *on the outside* with the Vendors name and address and the following information:

Bid Name: Eastern Middle School Secure Entrance
Bid Number: 2588-26
Opening Date: 12/9/26
Opening Time: 11:00 a.m.

Mandatory Walk-through:
Eastern Middle School 51 Hendrie Avenue, Greenwich, CT 06878
November 18, 2026 @ 3:30 p.m.

The Bid opening will be in person at 290 Greenwich Avenue, Greenwich, CT 06830 on December 9, 2026 at 11:00 a.m.

Very truly yours,

Eugene H. Watts

Information to Bidders

1. BACKGROUND:

Greenwich Public Schools of Greenwich, CT is about 35 miles northeast of New York City and has a population of about 62,000 people. The Greenwich Public Schools enjoy a national reputation for excellence and have strong support from the community. Our fifteen public schools have a current enrollment of 9000 students and consist of eleven elementary schools (K-5), three middle schools (6-8), and one comprehensive high school (9-12). Our district also offers some pre-K and alternative high schools' programs.

2. CONTRACT LENGTH:

This Bid is for awarding a contract to cover the period beginning on or about June 25, 2027. Once this Bid is awarded, the bidder must arrange to meet with Greenwich Public Schools if required.

3. OPTION TO EXTEND:

Greenwich Public Schools may, at their option extend the period of this agreement.

4. BID EVALUATION CRITERIA:

A committee composed of various administrators will evaluate bids. The following criteria guidelines will be used in analyzing and evaluating this bid:

Conformance to the requirements of this Bid, i.e. conformance to Terms, Conditions, Insurance Requirements and Scope of Work.
Proven skills and technical competence.
Background on the firm
For Vendor firm, identification of personnel who will have principal responsibility.
Qualifications Form

5. A NARRATIVE DESCRIBING THE FIRMS APPROACH TO UNDERTAKING THE SCOPE OF THE WORK INCLUDING:

Cost/service fee (overall cost to the Greenwich Public Schools with all factors considered).
Presentation to the selection committee, if requested.

6. OVERVIEW:

Greenwich Public Schools wishes to solicit Request for Bids for Eastern Middle School Secure Entrance**,** including any alternates. Companies must be located within a 200-mile radius of the district in order to submit a bid. It is understood that any contract is subject to available funding.

7. THE DETAILED BIDDER SHALL INCLUDE:

An outline of the procedures to be used to provide Eastern Middle School Secure Entrance indicated above, and how cost estimates will be calculated.

8. CONTRACTOR AGREEMENT

Contractor(s) whose bid exceeds $1,000,000.00 shall hold a current" DAS" Contractor ,Prequalification Certificate" (not a predetermination letter) from the Department of Administrative Services of the State of Connecticut according to Connecticut General Statutes Section 4a-100, 4b-101 and 4b-91 previously stated as Public Act 03-215 and as amended by Public Act 04-141. Bidders shall submit with their bids, unless noted otherwise, a "DAS Contractor Prequalification Certificate" along with a current "Update (bid) Statement". Failure to submit those items with the bid will result in disqualification of the bidder. If you have any questions regarding these requirements contact the State of CT.DAS, at telephone number 860-713-5280 or visit their web site at www.das.state.ct.us .

1. The contractor shall simultaneously with the signing of the Contract, furnish Greenwich Public Schools the executed Performance, Maintenance, and Payment Bond of a surety company authorized to do business in the State of Connecticut, and acceptable to Greenwich Public Schools, in the sum of the full amount of the Contract Obligation in the form provided by Greenwich Public Schools. Performance, Maintenance, and Payment Bond will not be required where the total estimated cost of labor and materials under the contract with respect to which such general bid is submitted is less than one-hundred thousand dollars ($100,000.00). Once a contract exceeds $100,000.00 the bidder will be responsible for obtaining and paying for all bonds required by Greenwich Public Schools.

2. Each bidder shall utilize the specified manufacturers. Should the Contractor desire to substitute other articles, materials, apparatus, products or process, then those specified or approved as equal, the Contractor shall apply to the Architect, in writing, for approval of such substitution, per Section 016000 Product Requirements. It should be noted that the Bid shall not be based on a substituted article, material, apparatus, product or process. No substitution reviews shall take place prior to bid.

3. Each form of bid contains a section for alternates and/or unit prices. All alternate prices must be completed with a dollar value. Blanks, not applicable (n/a), no effect, etc. in these portions of the form of bid shall be construed to indicate that the particular alternate shall be performed without increase to the contract price as they relate to the scope of the trade package.

4. Unit prices which do not affect the work of your trade may be filled in "not applicable (n/a)". "Not applicable or blanks in these portions of the form of bid shall be construed to indicate that the unit price is not applicable as they relate to the scope of the trade package.

5. The successful bidder will produce for the Greenwich Public Schools review a current financial statement, which will remain strictly confidential.

6. Each bid shall be accompanied by a completely filled in and properly executed Non-Collusion Affidavit.

7. All work shall be done in accordance with applicable State statutes; conditions of Prevailing Wages shall apply.

8. Qualifications to the bid are not allowed. If bids are qualified, they may be deemed non-responsive and subsequently rejected.

9. If there is a conflict between the Contract Agreement and the General Conditions, the Contract Agreement shall prevail.

10. Bid awards must be approved by the Greenwich Public Schools. All contractors shall be required to execute the Greenwich Public Schools standard form of contract and accompanying payment and performance bonds without exception.

11. The contract shall be awarded to the lowest responsible and qualified bidder, meaning the bidder whose bid is the lowest of those bidders possessing the skill, ability and integrity necessary to faithful performance of the work based on objective criteria considering past performance and financial responsibility. In considering past performance, the Greenwich Public Schools shall evaluate the skill, ability and integrity of bidders in terms of the bidders' fulfillment of contract obligations and of the bidders' experience or lack of experience with projects of similar size and scope. The Greenwich Public Schools reserves the right to consider as unqualified to do the work required by the bid documents any bidder that does not habitually perform with its own forces the major portion of the work involved in the bid documents. No contract will be awarded to any bidder who is at time of award not qualified under applicable regulations issued by the Secretary of Labor, United States Department of Labor or any applicable State and local laws and regulations.

9. QUESTIONS:

Questions concerning this Bid will be received by e-mail only directed to the Bid Department at: (bid_department@greenwich.k12.ct.us). In the subject line you must put Bid# 2588-26. All questions must be received no later than November 24, 2026 at noon. All answers will be posted as an addendum to our website, www.greenwichschools.org no later than noon on December 2, 2026. Failure to comply with these conditions will result in the bidder waving his/her right to dispute the Bid specifications and conditions. It is the bidder's responsibility to check our website for all addenda up to the day before the opening date. Failure to comply with these conditions will result in the bidder waiving his right to dispute the bid specifications and conditions.

10. ACCEPTANCE:

The department will make determination of the acceptability of work. Work shall be completed in a responsive and professional manner and in accordance with the specifications.

11. GENERAL TERMS AND CONDITIONS:

Sealed bids for furnishing Eastern Middle School Secure Entrance as specified on the attached bid specification sheets, will be received at the time and date previously mentioned.

Greenwich Public Schools reserves the right to waive any informality in the bid or reject any or all bids or to accept any bid, which appears to be in the best interest of the district. Any bid may be withdrawn prior to the opening time and date. Any bid received after the time and date as specified will not be considered.

Greenwich Public Schools shall have the right to take such steps as it deems necessary to determine the ability of the bidder to perform the work and the bidder shall furnish the Greenwich Public Schools with information and data for this purpose as the Greenwich Public Schools may request. The right is reserved to reject any bid where, on investigation, the evidence or information submitted by such bidders does not satisfy the Greenwich Public Schools that the bidder is qualified to carry out properly the terms of the contract. Consumption or use of alcohol and/or drugs is prohibited on school property. Any individual with alcohol or drugs will be removed from said property. Smoking is prohibited in all school buildings and on school grounds.

12. TAX:

No amount shall be added for the Connecticut Sales Tax or Federal Tax. The Greenwich Public School system is exempt from the payment of taxes imposed by the Federal Government and/or State of Connecticut. Taxes must not be included in the bid price.

13. INTENT:

The intention of this BID is to establish a contract with one bidder who will, upon request, provide the time with the services, labor, and supplies described in this solicitation. This is no guarantee as to the amount of services, labor or supplies that the Greenwich Public Schools may purchase during the term of this contract.

14. BACKGROUND CHECK

If applicable, Per Connecticut General Statutes CGS § 10-221d, which went into effect July 1, 2016, and 10-222c, all people who are entering into a paid agreement with a school district must submit to a mandatory background check. If you are an individual, you must send me your employment history so that I can do the background check. If you are a company having multiple employees in the schools, you will be responsible for obtaining the background checks on each of your employees.

15. APPROPRIATION:

The appropriation of funds for this project is contingent upon budget approval.

16. FORM AND SUBMISSION OF BID

a. One copy of this document will be furnished to the bidders. The Bid Sheet shall be completed and returned as part of the bid. The copy submitted by the successful bidder shall be completed in its entirety, executed and retained by Greenwich Public Schools of Greenwich, sometimes referred to as Greenwich Public Schools. From this executed copy, three other conformed copies will be made, one of which will be sent to the Contractor.

b. Bid Documents must be enclosed in a sealed opaque envelope plainly marked on the outside with the name and address of the Contractor; addressed to the Purchasing Agent, Greenwich Public Schools, Havemeyer Building, 290 Greenwich Avenue, Greenwich, Connecticut, and shall be labeled as indicated in Invitation to Bidders.

c. It shall be the responsibility of each Bidder to have his Bid/Proposal at the Business Office at the time of Bid Opening; neither Greenwich Public Schools of Greenwich nor the Town of Greenwich shall be held in any way for failure of bidder to have his Bid/Proposal submitted at such time and Bids arriving after the indicated Bid Opening time will not be accepted. Late bids arriving by mail shall be returned to the sender unopened.

17. BID SECURITY

Each Bid must be accompanied by Bid Bond prepared on the Form of Bid Bond attached hereto duly executed and acknowledged by the Bidder, as Principal, and by a surety satisfactory to Town as Surety. Bid Bond shall be in the sum of 10% of bid amount and shall be enclosed in the sealed envelope containing the Bid. Each such Bid Bond may be held by Greenwich Public Schools as security for the fulfillment of the Bidder's agreements as hereinabove set forth and as set forth in the Bid. Should the Bidder fail to fulfill such agreements, the Bid Bond shall become payable to Greenwich Public Schools as liquidated damages; otherwise, the Bid Bond shall become null and void. A BID BOND will not be required where the total estimated cost of labor and materials under the contract with respect to which such general bid is submitted is less than fifty thousand dollars ($50,000).

18. WITHDRAWAL OF BIDS

Except as hereinafter in this subsection expressly provided, once a Bid is submitted and received by the Greenwich Public Schools for consideration and comparison with the other bids similarly submitted, the Bidder agrees that the bid may not and will not withdraw it within thirty (30) consecutive calendar days after the actual date of the opening of Bids unless extended by addendum.

Upon proper written request and identification, Bids may be withdrawn only as follows:

a. At any time prior to the designated time for the opening of bids.

b. Unless a Bid is withdrawn as provided above, the Bidder agrees that it shall be deemed open for acceptance until the Agreement has been executed by both parties thereto or until Greenwich Public Schools notifies a Bidder in writing that his Bid is rejected or that Greenwich Public Schools does not intend to accept it. Notice of acceptance of a Bid shall not constitute rejection of any other Bid.

19. BIDDERS TO INVESTIGATE

Where applicable, Bidders are required to submit their Bids upon the following express conditions which shall apply to and be deemed a part of every Bid received.

Bidders must satisfy themselves by personal examination of the site of the work and by such means as they may wish, as to the actual conditions there existing, the character and requirements of the work, and the difficulties attendant upon its execution, and the accuracy of all estimated quantities, if any, stated in the Bid.

20. ABILITY AND EXPERIENCE OF BIDDER

No award will be made to any Bidder who cannot satisfy Greenwich Public Schools that he has sufficient ability and experience in this class of work and sufficient capital and plant to enable him to prosecute and complete the work successfully within the time named or where such time is not named, within a reasonable period of time as is determined by the contracting officer or agency. Greenwich Public Schools decision or judgment on these matters shall be final, conclusive and binding.

Greenwich Public Schools may make such investigations as it deems necessary, and the Bidder shall furnish to Greenwich Public Schools, under oath if so required, all such information and data for this purpose as Greenwich Public Schools may request.

21. INTERPRETATIONS

The Contractor agrees to use the products and methods designated or described in the specifications or as amended by the addenda.

a. Bids. Greenwich Public Schools reserves the right to reject Bids which in its judgment are either incomplete, conditional, obscure, or not responsible or which contain additions not called for, erasures not properly initialed, alterations or similar irregularities if deemed in Greenwich Public Schools best interest to do so.

b. Right to Reject or Accept Bids. Greenwich Public Schools reserves the right to reject any and all bids not deemed to be in the best interest of Greenwich Public Schools. Greenwich Public Schools reserves the right to waive any informalities in or reject any or all bids, or any part of any bid.

c. Execution of Agreement. The Bidder whose Bid is accepted will be required and agrees to duly execute the Agreement and furnish the required Bond within such time as deemed reasonable by Greenwich Public Schools or Contracting Officer.

d. Non-Connecticut Contractors 5 % Tax.
Pursuant to Connecticut General Statutes § 12-430(7), as amended by Public Act No11,61, Section 66, a non-resident contractor shall comply with the State of Connecticut's bonding requirements.

22. BID BOND

a. The Bid Bond form given on the following pages shall be used.

b. The surety on the bond may be any corporation authorized to act as surety in the State of Connecticut.

c. The full name and business or residence address of each individual party to the bond shall be inserted in the space provided therefore, and each party shall sign the bond with his usual signature on the line opposite the scroll seal.

d. If the principals are partners, their individual names shall appear in the space provided here fore, with the recital that they are partners composing a firm, naming it, and the bond shall be executed by a general partner who has been authorized to act on behalf of the partnership.

e. If the principal or surety is a corporation, the name of the state in which incorporate shall be inserted in the space provided therefore, and said instrument shall be executed and attested under the corporate seal, the fact shall be stated, in which case a scroll or adhesive seal shall appear following the corporate name.

f. The official character and authority of the person or persons executing the bond for a corporation shall be certified by a proper officer. In lieu of such certificate, there may be attached to the bond copies of so much of the records of the corporation as will show the official character and authority of the officers signing duly certified by a proper officer, under the corporate seal, to be true copies.

g. The date of this bond must not be prior to the date of the instrument in connection with which it is given.

23. MINIMUM WAGES AND PAYMENT TO SUBCONTRACTORS

a. The work specified in this contract is subject to prevailing wage rates as fixed by the Labor Commissioner of the State of Connecticut and a schedule of such rates is deemed to be incorporated herein.

b. A general or prime contractor is required by Connecticut law to pay his subcontractors for labor performed or materials furnished within forty-five (45) days after payment to such general or prime contractor.

c. The contractor's attention is directed to Section 25 of the Agreement for additional requirements for Employment Preference and Minimum Wage.

24. INSURANCE:

Before starting and until final completion and acceptance of the work called for in the Contract and expiration of the guarantee period provided for in the Contract, the Contractor shall procure and maintain insurance of the types and amounts indicated in paragraphs A through F inclusive, below, and such other insurance as is specified under any special conditions to the Contract. The Town of Greenwich, The Greenwich Board of Education, Greenwich Public Schools and Silver Petrucelli + Associates shall be named as an additional insured on each such policy of insurance. The Contractor shall require each of its subcontractors to procure and maintain, until the final completion of each sub-contractor's work, insurance of the types and amounts specified in paragraphs A through F inclusive, below, which shall be in addition to the obligation of the Contractor to secure and maintain at its expense, during the life of this Contract, public liability and property damage insurance to protect it, its sub-contractors, if any, and Greenwich Public Schools from claims for bodily injury, accidental death or property damage arising from the operations under this Contract (including blasting and the handling and storage of explosives) whether such operations be by the Contractor or anyone directly or indirectly employed by it.

25. EMPLOYMENT PREFERENCE AND MINIMUM WAGE RATES:

In the employment of labor to perform the construction, remodeling or repairing of any public building specified herein, by the State or any of its agents, or by persons contracting therewith, preference shall be given to citizens of the United States, who are, and continuously for at least three months prior to the date hereof have been, residents of the labor market area, as established by the labor commissioner of the State of Connecticut, in which such work is to be done, and if no such qualified person is available, then to citizens who have continuously resided in the county in which the work is to be performed for at least three months prior to the date hereof, and then to citizens of the state who have continuously resided in the state at least three months prior to the date hereof. In no event shall said provisions be deemed to abrogate or supersede, in any manner, any provision regarding residence requirements contained in a collective bargaining agreement to which the Contractor is a party. In the employment of mechanics or workmen to perform the work specified herein, in connection with any public works project, including, but not limited to construction, remodeling or repairing of any public facility, structure, except public buildings covered by the preceding paragraph, site preparation or site improvement, appurtenances or highways or in preparation or improvement of any land or waterway on or in which a structure is situated or to be constructed by the state or any of its agents or by persons contracting therewith, preference shall be given to residents of the state who are, and continuously for at least six months prior to the date hereof have been, residents of this state, and if no such person is available then to residents of other states.

The provisions of the two immediately preceding paragraphs of this section shall not apply where the state or any subdivision thereof may suffer the loss of revenue granted or to be granted from any agency or department of the federal government as a result of the two immediately preceding paragraphs of this section or regulative procedures pursuant thereto.

The wages paid on an hourly basis to any mechanic, laborer, or workman employed upon the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of such employee to any employee welfare fund, as defined in Section 31-53(h) Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in Greenwich Public Schools. Any Contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wages the amount of payment or contribution for his classification on each pay day.

The provisions of the immediately preceding paragraph shall not apply where the total cost of all work to be performed by all contractors and subcontractors in connection with new construction of any public works project is less than four hundred thousand dollars ($400,000) or where the total cost of all work to be performed by all contractors and subcontractors in connection with any remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works projects is less than one hundred thousand dollars ($100,000).

26. FINAL PAYMENT:

When the Contractor has completed the work under this Contract he shall submit his bill for final payment to the Assistant Facilities Director for approval. The bill shall be submitted on the Contractor's billhead indicating date, contract number, work performed, and amount of bill along with an executed Affidavit for Final Payment which is part of the Contractor's conformed copy of the Contract. Receipt of this bill shall in no way obligate Greenwich Public Schools to accept the work under this Contract as complete and satisfactory. Within one week from date of receipt of the bill, the Assistant Facilities Director or his representative will inspect the work and if deficiencies are found the Contractor shall be notified in writing of each deficiency. The final payment shall not be made until the Assistant Facilities Director approves the work as complete, satisfactory and in compliance with the Contract Document.

27. RIGHT TO ALTER FORM, QUANTITY, ETC., OF WORK:

Greenwich Public Schools further reserves the right to make alterations in the lines, grade, plan, the commencement of work because of the priority restrictions, insufficient funds in appropriations, or other cause. If such alterations diminish the quantity of the work to be done, they shall not constitute a claim for damage, or for anticipated profits on the work dispensed with, or affect the prices bid for the various classes of work remaining. If they increase the amount of work, such increase shall be paid for according to the quantity actually done and at the price or prices bid for various classes of work, or if not susceptible of classification, to so agree, the Contractor shall do the work as aforesaid as extra work.

28. SAFETY SPECIFICATIONS

Site Conduct: Contractor acknowledges that the Work will be conducted at an operating public school, which may inhibit the operations of Contractor and its Subcontractors and Vendors. Parking for workers, vendors, and visitors will be allowed only at an area designated by Owner.

If necessary, Contractor shall provide transportation for all workers between the Site and such remote parking as will be provided to the Contractor. Contractor shall prohibit, and shall use all reasonable efforts to prevent it, and its Subcontractors' and Vendors', personnel from

loitering or wandering in the School. Contractor shall also prohibit, and shall use all reasonable efforts to prevent, on or near the Site, the use or consumption of alcoholic beverages, drugs, or other mind-altering substances, the carrying of firearms or other weapons, fighting, and conduct that is disorderly, or disruptive, in a business setting. Contractor shall promptly terminate, or have terminated, the employment of any person employed by Contractor, or a Subcontractor or Vendor, whose employment Owner designates to be terminated due to violation of any laws or rules applicable to the site or the school.

Safety: The safety of Contractor, Subcontractors, Vendors and their employees, agents, representative and invitees, and any other person who enters the Site for any purpose relating to Contractor's carrying out its obligations under this Agreement (including Owner and its employees, agents, representatives and invitees) shall be Contractor's responsibility. Contractor shall promptly notify Owner, in writing, of any hazardous conditions, property or Equipment at the Site. If Owner requests that Contractor provide certain safeguards required in Owner's reasonable judgment for the protection of persons, or property, on or near the Site and Contractor fails to comply with such request within a reasonable time, Owner may provide such safeguards, and Contractor shall promptly reimburse Owner for the costs thereof. Such provision by Owner shall not relieve Contractor of its obligations or liabilities hereunder, nor shall it make Owner responsible for Site safety or Contractor's means and methods to ensure Site safety. Contractor shall initiate and maintain safety precautions and programs to conform with applicable laws and otherwise to protect against and prevent injury to persons or damage to property on, about, or adjacent to the Site and shall incorporate all such safety precautions and programs (the "Site Safety Program") in a written safety program manual (the "Site Safety Manual"). Contractor shall erect and maintain safeguards for the protection of workers and the public consistent with its obligations under the Agreement. Contractor shall exercise efforts to eliminate, or abate, all reasonably foreseeable safety hazards created by or otherwise resulting from performance of the Work. Contractor shall ensure that it, its employees, agents and invitees and its Subcontractors, Vendors and their employees, agents and invitees, during performance of any of the Work, comply with (i) all applicable laws relating to health and safety, including the Occupational Safety and Health Act of 1970 (OSHA) and the rules and regulations promulgated thereunder, and (ii) all directions by Owner regarding protective clothing, head covering, eye protection, and the like. Prior to commencing Work, Contractor or designate to Owner (i) one of its employees to act as the Site's safety officer (the "Site Safety Officer") and (ii) certain of its employees to act as the Site's first aid staff, which employees shall be properly trained and qualified. Contractor's Site Safety Officer shall attend and pass Owner's fire watch training session, or a similar session, with advance approval by Owner. Contractor shall not terminate the employment of the Site Safety Officer without Owner's prior written consent. Contractor's Site Safety Officer and first aid staff shall have such responsibilities as Owner and Contractor may from time to time agree. Owner may from time to time designate its own Site safety officer or first aid staff to whom Contractor's Site Safety Officer and staff shall report.

Safety Records: Contractor shall furnish the safety records of Contractor and its Subcontractors, including their experience modification rate, OSHA Injury Index, OSHA Days Away from Work Index.

Hot Work Permits: At least twenty-four (24) hours in advance of performing Work in Hazardous Areas, Contractor's Representative shall notify General Contractor that such work is necessary, obtain General Contractor's prior written approval to perform such work, and, if approved, provide General Contractor with Hot Work Maps and obtain Hot Work Permits from General Contractor's Representative.

Daily Safe Work Permits: On a daily basis, prior to performing any Work, Contractor shall obtain Daily Safe Work Permits from the Owner.

Differing Site Conditions: Contractor shall, promptly after actual discovery, and before such conditions are disturbed (to the extent reasonably practicable), notify Owner in writing of (i) any subsurface or latent physical conditions at the Site, differing materially from those indicated in, or reasonably inferable from, the Supplied Project Documents that could not have been observed through a reasonable inspection of the Site, prior to commencing Work, or (ii) unknown physical conditions at the Site of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Agreement. After receipt of such notice, Owner shall promptly investigate the conditions. In the event that such conditions do materially differ and actually result in a material increase or decrease in Contractor's cost of, or the time required for performance of, the Work, Contractor may be entitled to additional or a reduction in compensation under Agreement as applicable. No adjustment in compensation shall be allowed under this Paragraph unless Contractor has promptly given the notice required in this Paragraph.

Site Housekeeping: Contractor shall keep the Site free from trash, contamination, refuse, rubbish, scrap materials, and debris caused, or created by, Contractor or its Subcontractors and shall keep the Site in a reasonably presentable condition given the nature of the Work and in a neat, orderly, and workmanlike apace. Owner may from time to time instruct Contractor to place the Site in such condition. If Contractor fails to do so within a reasonable period of time, Owner may do so and charge Contractor for the actual cost thereof. Contractor shall dispose of trash, refuse, rubbish, scrap material, and debris in an authorized landfill. Contractor shall not burn, or bury, any such items. Contractor shall cause all Contractor generated Hazardous Substances that are transported by Contractor to the Site to be disposed of by licensed transporters in accordance with the requirements of all applicable laws.

Maintenance of Roadways: Contractor shall protect all maintained roads, driveways, and bridges which may be damaged in connection with the work, and shall repair, or replace, them if damaged, at its own expense, to the satisfaction of the governmental authorities or Owner. It is the responsibility of the Contractor to identify the potential for damage and take proper preventative measures to prevent damage to maintained or unmaintained roads, drives, or bridges. Cost of preventative measures shall be submitted to Owner, prior to commencement of work and will be on a reimbursable basis. Contractor shall not block any main thoroughfares in School property without prior approval from Owner. No lug type rigs, bulldozers, or other tract type equipment may be used without prior approval from the Owner. If these rigs are used, appropriate protection must be used to prevent damage to roadways.

Clean-Up: As part of the work included in this Contract, the Contractor shall completely remove and satisfactorily dispose of all temporary buildings placed by the Contractor; shall remove or grade, to the extent directed, all embankments or cofferdams made for construction purposes; shall satisfactorily dispose of all rubbish resulting from the operations under this Agreement; and
shall do all work necessary to restore the territory embraced within the site of its operations to at least as good order and conditions at the beginning of the work under this contract. Notwithstanding the foregoing, any work concerning Hazardous Substances shall be performed only in accordance with the contract and all applicable laws.

Training and Operations Manuals: Contractor shall provide, either itself or through its subcontractors or vendors, specific operations and maintenance training to Owner's personnel for the Equipment and systems that Contractor provides. As to such Equipment and systems, Contractor shall provide to Owner final operations manuals, record drawings, specifications, priced spare parts lists and design sheets.

REFERENCES:

Please list at least five (5) school districts of similar size to Greenwich Public Schools where you or your company has performed these services.

1._____
NAME AND ADDRESS

_____
TELEPHONE # FAX # EMAIL

_____
CONTACT PERSON AND TELEPHONE NUMBER

2._____
NAME AND ADDRESS

_____
TELEPHONE # FAX # EMAIL

_____
CONTACT PERSON AND TELEPHONE NUMBER

3._____
NAME AND ADDRESS

_____
TELEPHONE # FAX # EMAIL

_____
CONTACT PERSON AND TELEPHONE NUMBER

4._____
NAME AND ADDRESS

_____
TELEPHONE # FAX # EMAIL

_____
CONTACT PERSON AND TELEPHONE NUMBER

5._____
NAME AND ADDRESS

_____
TELEPHONE # FAX # EMAIL

_____
CONTACT PERSON AND TELEPHONE NUMBER

GREENWICH PUBLIC SCHOOLS
REQUEST FOR BID #2588-26 DEADLINE: December 9, 2026 @ 11:00 am

Eastern Middle School Secure Entrance
REPLY SHEET (Page 1of 2)

STATEMENT OF NON-COLLUSION

In submitting this bid/proposal, the undersigned declares that this is made without any connection with any persons making another bid/proposal on the same contract; that the bid/proposal is in all respects fair and without collusion, fraud, or mental reservation; and that no elected or appointed official of Greenwich Public Schools, or any person or entity in the employ of Greenwich Public Schools, is directly or indirectly interested in said bid/proposal or in the supplies or work to which it relates, or in any portion of the profits thereof, except as permitted under Greenwich Public Schools of Greenwich Code of Ethics.

CODE OF ETHICS

In submitting this bid, the undersigned further declares and certifies that a) it has not, and will not induce or attempt to induce any Town of Greenwich employee or officer to violate Greenwich Public Schools of Greenwich Code of Ethics in connection with its offer to provide goods or services under, or otherwise in the performance of, such contract, and b) if an elected or appointed official or any person in the employ of Greenwich Public Schools has a direct or indirect interest in Vendor or any supplier or Subcontractor expected to be involved with the contract, such person or entity is in compliance with the safe harbor procedures established by Greenwich Public Schools of Greenwich Board of Ethics or has received an advisory from Greenwich Public Schools Board of Ethics with respect to such involvement.

The undersigned further understands that the above declarations are material representations to Greenwich Public Schools of Greenwich made as a condition to the acceptance of the bid/proposal. If found to be false, Greenwich Public Schools of Greenwich retains the right to reject said bid/proposal and rescind any resulting contract and/or purchase order and notify the undersigned accordingly, thereby declaring as void said bid/proposal and contract or purchase order.

Greenwich Public Schools of Greenwich Code of Ethics can be found at www.greenwichct.gov. Relevant provisions of Greenwich Public Schools Code of Ethics state:

Section 2. DEFINITIONS. (1) Indirect interest, without limiting its generality, shall mean and include the interest of any subcontractor in any prime contract with Greenwich Public Schools and the interest of any person or his immediate family in any corporation, firm, or partnership which has a direct or indirect interest in any transaction with Greenwich Public Schools. (2) Substantial financial interest shall mean any financial interest, direct or indirect, which is more than nominal, and which is not common to the interest of other citizens of Greenwich Public Schools. (3) Town officer shall mean and include any official, employee, agent, consultant, or member, elected or appointed, of any board, department, commission, committee, legislative body, or other agency of Greenwich Public Schools. (4) Transaction shall mean and include the offer, sale, or furnishing of any real or personal property, material, supplies, or services by any person, directly or indirectly, as Vendor, prime contractor, subcontractor, or otherwise, for the use and benefit of Greenwich Public Schools for a valuable consideration, excepting the services of any person as a Town officer.

Section 3. GIFTS AND FAVORS. No Town officer or his immediate family shall accept any valuable gift, thing, favor, loan, or promise that might influence the performance or nonperformance of his official duties.

Section 4. IMPROPER INFLUENCE. No Town officer having a substantial financial interest in any transaction with Greenwich Public Schools or in any action to be taken by Greenwich Public Schools shall use his office to exert his influence or to vote on such transaction or action.

By signing below, the undersigned acknowledges reviewing and understanding the Non-Collusion and Code of Ethics statements contained herein and confirms compliance with the contents:

AUTHORIZED SIGNATURE: _____

PRINT NAME: _____

BIDDER'S COMPANY NAME:_____

GREENWICH PUBLIC SCHOOLS
REQUEST FOR BID #2588-26 DEADLINE: December 9, 2026 @ 11:00 am

Eastern Middle School Secure Entrance
REPLY SHEET (Page 1 of 1)

BIDDER INFORMATION:

BIDDER'S COMPANY NAME _____

ADDRESS _____

_____

TELEPHONE # _____ _____

E-MAIL ADDRESS _____

WEB SITE _____

AUTHORIZED SIGNATURE _____

PRINT NAME _____

TITLE _____

STATE OF CT TAXPAYER ID # _____

FEDERAL TAXPAYER ID # _____

INCORPORATED IN THE STATE OF _____ **Corporate Seal** ☐ **Yes** ☐ **No**

AWARD/CONTRACT SIGNATURE

The Bidder shall indicate below, the full name, title, and the complete mailing address of the authorized person (i.e., **officer of the company**) who will sign the contract (if applicable) for this procurement:

_____
_____
_____
_____
_____
_____
_____

CONSENT OF SURETY

The undersigned surety, being the surety company, which issued Bond No. _____ for Greenwich Public Schools of Greenwich Contract No. _____ hereby consents to release of final payment and all retainages to the contractor – principal.

(Name of Surety)

By_____

Its

ACKNOWLEDGMENT

STATE OF

ss:

COUNTY OF

This is to certify that the above-named signatory who executed this instrument was either known to me or satisfactorily proven to me to be the person whom he purports to be.

_____

Notary Public

AFFIDAVIT FOR FINAL PAYMENT

The undersigned, being duly sworn, deposes and says:

1. That he is the _____ (Title) of the contractor in the project hereinafter referred to and is authorized to execute this affidavit on behalf of the contractor;

2. In connection with Contract #_____ for _____ (Project Title) it is represented that all payrolls, bills for services, materials, supplies, equipment and other indebtedness have been paid or otherwise satisfied and that there are no outstanding claims against the undersigned by any sub-contractor or material supplier, or no outstanding claims or intent to file a claim against Greenwich Public Schools of Greenwich;

3. This Affidavit is made at the request of Greenwich Public Schools of Greenwich for the purpose of inducing final payment and knowing that it will rely upon the truth of the representation herein made.

Subscribed and sworn to
before me this day
of 2026

_____ _____

Notary Public (Type or print name of person authorized to sign)

FORM OF BID BOND

TOWN OF GREENWICH, CONNECTICUT

Date Bond Executed

BID BOND

Principal

Surety

Penal Sum of Bond (express in words and figures) Date of Bid

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto Greenwich Public Schools of Greenwich, Connecticut, in the penal sum of the amount stated above, 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 OBLIGATION IS SUCH, that whereas the principal has submitted the accompanying bid, dated as shown above for _____.
(name of bid)

NOW THEREFORE, if the principal shall not withdraw said bid within the period specified therein after the opening of the same, or if no period be specified, within sixty (60) days after said opening, and shall within the period specified therefor, or if no period specified, within ten (10) days after the prescribed forms are presented to him for signature, execute such further contractual documents, if any, as may be required by the terms of the Bid as accepted, and give bonds with good and sufficient surety or sureties as may be required, for the faithful performance and proper fulfillment of the resulting contract, and for the protection of all persons supplying labor and materials in the prosecution of the work provided for in such contract or in the event of the withdrawal of said bid within the period specified, or the failure to enter into such contract and give such bonds within the time specified, if the principal shall pay Greenwich Public Schools of Greenwich, Connecticut, the difference between the amount specified in said bid and the amount for which said Town may procure the required work, supplies, and services, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF the above-bounden parties have executed this instrument under their several seals on the date indicated above. The name and corporate seal (if applicable) of each corporate party being hereto affixed:

_____

Name of Partnership

_____(SEAL)

Business Address

Partner – (Hereunto Duly Authorized)

IN THE PRESENCE OF:

WITNESS INDIVIDUAL PRINCIPAL

1._____AS TO_____(SEAL)

2._____AS TO_____(SEAL)

3._____AS TO_____(SEAL)

4._____AS TO_____(SEAL)

****

_____

CORPORATE / LLC PRINCIPAL

WITNESS

_____

BUSINESS ADDRESS AFFIX CORPORATE SEAL

_____

BY– (HEREUNTO DULY AUTHORIZED)

_____

TITLE

****

_____

CORPORATE SURETY

_____

WITNESS BUSINESS ADDRESS AFFIX CORPORATE SEAL

_____

_____

BY – (HEREUNTO DULY AUTHORIZED)

_____

TITLE

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the _____ of the corporation named as principal in the within bond; that _____, who signed said bond on behalf of the principal, was then _____ of the corporation; that I know his signature, and his signature thereto is genuine; and that said bond was duly signed, sealed and attested for and in behalf of said corporation by authority of its governing body.

_____

(Corporate Seal)

PERFORMANCE, MAINTENANCE AND PAYMENT BOND

BOND NO._____ CONTRACT NO. _____

KNOW ALL MEN BY THESE PRESENTS. That we_____

_____, as Principal, and

_____

a corporation organized under the laws of the State of _____ and authorized to do business in the State of Connecticut as Surety, are holden and firmly bound jointly and severally unto Greenwich Public Schools OF GREENWICH, CONNECTICUT, hereafter referred to as Greenwich Public Schools, a territorial corporation located in the County of Fairfield, in the penal sum of

_____Dollars ($_____),

to be paid to it or its certain attorney, successors or assigns, to which payment well and truly to be made, we the said Obligors do
bind ourselves, and each of us, our heirs, executors, administrators, and successors firmly by these presents.

IN WITNESS WHEREOF we have hereunto set or caused to be set our respective hands, names and seals this _____ day of _____ 20__.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the above-named Principal has entered into a certain written contract with Greenwich Public Schools OF GREENWICH, CONNECTICUT, dated the _____ day of_____ 20 , for construction of **CONTRACT NO. _____**

_____*(Description of work here – Usually the name of the bid)* according to the plans and specifications prepared by Greenwich Public Schools **OF GREENWICH**, which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, if the said Principal shall well and faithfully perform said contract according to its provisions, and fully indemnify and save harmless Greenwich Public Schools from all cost and damages which Greenwich Public Schools may suffer by reason of failure so to do, and shall pay for all equipment, appurtenances, materials and labor furnished, used or employed in the execution of said contract, and shall indemnify and save harmless Greenwich Public Schools from all suits or claims of any nature or description against Greenwich Public Schools by reason of any injuries or damages sustained by any person or persons on account of any act or omission of said Principal, his servants or agents, or his subcontractors in the construction of the work or in guarding the work, or on account of the use of faulty or improper materials, or by reason of claims under the Workmen's Compensation Laws or other laws by any employee of the Principal or his subcontractors, or by reason of the use of any patented material, machinery, device, equipment, process, method of construction or design in any way involved in the work, and shall indemnify Greenwich Public Schools against such defective workmanship, material and equipment as may be discovered within one (1) year after completion and final acceptance of the work, and shall make good in such defective workmanship and material as may be discovered within said period of one year, then this obligation shall be void, otherwise to remain in full force and effect.

The Surety hereby stipulates and agrees that any modifications, omissions or additions in or to the terms of the aforesaid contract, or in or to the plans or specifications therefor, or any extension of time, shall in no wise affect the obligation of the Surety under this bond, the Surety hereby waiving any and all right to any notice of any such modifications, omissions, changes, additions or extensions.

CONTRACTOR_____

BY_____

SURETY_____

BY_____

GREENWICH PUBLIC SCHOOLS
REQUEST FOR BID #2588-26 DEADLINE: December 9, 2026 @ 11:00 am

Eastern Middle School Secure Entrance
REPLY SHEET (Page 1 of 2)

INSURANCE PROCEDURES

THIS PAGE MUST BE RETURNED WITH YOUR BID. FAILURE TO DO SO MAY RESULT IN YOUR BID BEING REJECTED.

- This makes the page a **required part** of your bid submission.
- If you forget to return it, your bid could be ruled **non-responsive** and tossed out, even if everything else is correct.

1. Insurance Requirement Instructions

- The document tells you to take the insurance requirements in the bid packet to your **insurance agent or broker** right away.
- Purpose: so they can verify whether your existing insurance policies already meet the contract's requirements, or if you need to purchase **additional coverage**.
- Examples of such insurance might include:
    - General liability
    - Workers' compensation
    - Automobile liability
    - Umbrella

2. Rejection for Deficient Insurance

- If your bid shows that you cannot meet the insurance requirements (or if you ignore them), your bid will be rejected.
- Insurance is a way the buyer (the school district, city, or agency) protects itself against risk. They cannot accept a vendor without the required coverage.

3. Statement of Vendor

- This is essentially your certification/attestation that:
    1. You have read and understood the insurance requirements.
    2. You have discussed them with your insurance provider.
    3. Your bid price includes the cost of any additional insurance you may need to carry to comply with the contract.

When you and your broker/agent sign this statement, you are confirming that your bid is fully compliant with the insurance requirements.

GREENWICH PUBLIC SCHOOLS
REQUEST FOR BID #2588-26 DEADLINE: December 9, 2026 @ 11:00 am

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REPLY SHEET (Page 2 of 2)

In summary:
This page is a required acknowledgment. By signing and returning it, you confirm that you understand the insurance obligations, have factored any extra insurance costs into your bid, and are *capable of providing the coverage within 2 weeks of being awarded the bid*. Without this page (or without proper insurance), your bid can be rejected.

STATEMENT OF VENDOR:

I have read the insurance requirements for this work and have taken the documentation to my insurance agent/broker. The bid cost reflects any additional costs relating to insurance requirements for this work.

_____
Agent/Broker Name & Title

_____
Signature Date

_____
Bidder's Company Name

_____
Name & Title

_____
Signature Date

Insurance Requirement Sheet

Insurance Requirements: Before starting and until final completion and acceptance of the work called for in the Contract and expiration of the guarantee period provided for in the Contract, the Contractor and its subcontractors, if any, shall procure and maintain insurance of the types and amounts checked in paragraphs A through F below for all Contract operations. If any of the required insurance is on a claims made basis and does not include an extended reporting period of at least 36 months, contractor shall maintain either tail coverage or continuous claims made liability coverage, provided the effective date of the continuous claims made coverage is on or before the effective date of the contract with the Town, for a minimum of months following the later of (i) contractor's completion and Town's acceptance of all services required under the contract, or, (ii) Town or contractor termination of contract, or, (iii) the expiration of the claims made policy. The Town of Greenwich shall be given thirty (30) days prior written notice of cancellation, lapse or restrictive amendment (except ten days' notice of nonpayment) of the policies listed in the Acord form.

☒ **A. General Liability, with minimum coverages for combined bodily injury and property damage liability of $2,000,000 Aggregate and $1,000,000 per occurrence including:**

☒ **1. Commercial General Liability which meets or exceeds the coverage in Commercial General Liability ISO Form CG 00011001 or CG 00010413, including contractual liability.**

☒ **2. Town of Greenwich The Greenwich Board of Education, Greenwich Public Schools and Silver Petrucelli + Associates as additional insured. Contractor's insurance must be primary and non-contributory – and stated as such in the Description of Operations section of the Acord form.**

☐ **3. Owners and Contractors Protective Liability (separate policy in the name of the Town).**

☒ **B. Comprehensive Automobile Liability, with minimum coverages of $1,000,000 combined single limit for bodily injury and property damage, including, where applicable, coverage for any vehicle, all owned vehicles, scheduled vehicles, hired vehicles, non-owned vehicles and garage liability.**

☒ **C. Excess Liability, with minimum coverage of $5,000,000 in umbrella form, or such other form as approved by Town Department Head and Risk Management Director.**

☒ **D. Workers' Compensation and Employer's Liability, with minimum coverages as provided by Connecticut State Statutes.**

☐ **E. Professional Liability (for design and other professionals for Errors and Omissions), with minimum coverage of $1,000,000. If the policy is on a claims-made basis, coverage shall be continually renewed or extended for three (3) years after work is completed under the Contract.**

☐ **F. Other:_____.**

☒ **G. CERTIFICATE HOLDER: TOWN OF GREENWICH (Also indicate on Acord Certificate of Insurance)**
101 Field Point Road, Greenwich, CT 06830.

The Description of Operations on the Acord certificate of insurance must state the Project Name, the Contract Number and the following: "Town of Greenwich, The Greenwich Board of Education, Greenwich Public Schools and Silver Petrucelli & Associates Architects are additional insured, Contractor's insurance is primary and non-contributory, General Liability coverage meets or exceeds the coverage in Commercial General Liability ISO Form CG 00 01 10 01, or CG 00 01 04 13, including contractual liability. Town of Greenwich will be given 30 days prior written notice of cancellation, lapse or restrictive amendment (except 10 days' notice of non-payment) of the policies listed on the Acord form."

The Acord certificate of insurance form must be executed by your insurance agent/broker. The most current Acord form should be used. Company name and address must conform on all documents including insurance documentation. List the individual insurance companies, rather than the insurance group, on the Acord form. Check the appropriate box to indicate Town of Greenwich, The Greenwich Board of Education, Greenwich Public Schools and Silver Petrucelli & Associates Architects are endorsed as an additional insured. Contract development will begin upon receipt of complete, correct insurance documentation.

The Contractor shall be responsible for maintaining the above insurance coverages in force to secure all of the Contractor's obligations under the Contract with an insurance company or companies with an AM Best Rating of A-:VII or better, licensed to write such insurance in Connecticut and acceptable to the Risk Manager, Town of Greenwich. For excess liability only, non-admitted insurers are acceptable, provided they are permitted to do business through Connecticut excess line brokers per listing on the current list of Licensed Insurance Companies, Approved Reinsurers, Surplus Lines Insurers and Risk Retention Groups issued by the State of Connecticut Insurance Department.

(SAMPLE ENDORSEMENT LETTER)

AGENT/BROKER
(LETTERHEAD)

(Date)

Eugene H. Watts, Manager of School Procurement
Purchasing Department
Greenwich Public Schools
290 Greenwich Avenue
Greenwich, CT 06830

Re: Greenwich Public Schools **Contract #_____**

Dear Mr. Watts:

The undersigned hereby certifies as follows:

(1) I am a duly licensed insurance agent under the laws of the State of Connecticut**]** and an authorized representative of all companies affording coverage under the Acord form submitted herewith;

(2) The Town of Greenwich, The Greenwich Board of Education, Greenwich Public Schools and Silver Petrucelli & Associates Architects have been endorsed as additional insured under the general liability policy no. [insert policy number], issued by **[insert company affording coverage] to [name of insured]**;

(3) The general liability policy referenced in paragraph (2) above meets or exceeds the coverage in Commercial General Liability ISO form CG 00 01 10 01, including contractual liability;

(4) The policies listed in the Acord form submitted to Greenwich Public Schools of Greenwich in connection with the above-referenced contract have been issued to the insured in the amounts stated and for the periods indicated in the Acord form; and

(5) Greenwich Public Schools of Greenwich shall be given thirty (30) days prior written notice of cancellation, lapse or restrictive amendment (except ten days' notice of nonpayment) of the policies listed in the Acord form.

Sincerely,

Authorized Representative for all companies listed in the Acord form

ACORD

CERTIFICATE OF LIABILITY INSURANCE

PRODUCER	THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER, THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.
	INSUREERS AFFORDING COVERAGE
	INSURER A:
	INSURER B:
	INSURER C:
	INSURER D:
	INSURER E:

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OF CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE(MM/DD/YY)	POLICY EXPIRATION DATE(MM/DD/YY)	LIMITS	
	GENERAL LIABILITY COMMERCIAL GENERAL LIABILITY ☐ CLAIMS MADE ☒ OCCUR ☐ _____ ☐ _____ GENERAL AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☐PROJECT ☐ LOC				EACH OCCURRENCE	$1,000,000
					FIRE DAMAGE (Any one fire)	
					MED EXP (Any one person)	
					PERSONAL & ADV INJURY	
					GENERAL AGGRREGATE	$2,000,00
					PRODUCTS-COMP/OP AGG	
	AUTOMOBILE LIABILITY ☐ ANY AUTO ALL OWNED AUTOS ANY PROPRIETOR/PARTNER/EXECUTIVE SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS ☐ _____ ☐				COMBINED SINGLE LIMIT (Ea accident)	$1,000,00
					BODILY INJURY (Per person)	
					BODILY INJURY (Per accident)	
					PROPERTY DAMAGE (Per accident)	
	GARAGE LIABILITY ☐ ANY AUTO ☐				AUTO ONLY-EA ACCIDENT	
					OTHER THAN AUTO ONLY:	EA ACC AGG
	EXCESS LIABILITY ☐ OCCUR ☐ CLAIMS MADE ☐ DEDUCTIBLE ☐ RETENTION $				EACH OCCURRENCE	$5,000,00
					AGGREGATE	$5,000,00
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N ☐ (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATION below)				☒ PER STATUTE ☐ OTHER	
					E.L. EACH ACCIDENT	
					E.L. DISEASE-EA EMPLOYEE	
					E.L. DISEASE – POLICY LIMIT	

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

The Town of Greenwich, The Greenwich Board of Education, Greenwich Public Schools and Silver Petrucelli & Associates Architects are named as additional insured for Contract # _____. It is agreed by both parties to Contract # ____ that the Contractors insurance will be primary and non-contributory

CERTIFICATE HOLDER	X	ADDITIONAL INSURED; INSURER LETTER: __	CANCELLATION
Greenwich Public Schools Attn: Purchasing Dept. 290 Greenwich Avenue Greenwich, CT 06830			SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OF REPRESENTATIONS AUTHORIZED REPRESETNATIVE

COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES
CONTRACT COMPLIANCE REGULATIONS
NOTIFICATION TO BIDDERS

AFFIRMATIVE ACTION COMPLIANCE AFFIDAVIT

The contract to be awarded is subject to contract compliance requirements mandated by Sections 4a-60 and 4a-60a of the Connecticut General Statutes; and, when the awarding agency is the State, Sections 46a-71(d) and 46a-81i(d) of the Connecticut General Statutes. There are Contract Compliance Regulations codified at Section 46a-68j-21 through 43 of the Regulations of Connecticut State Agencies, which establish a procedure for awarding all contracts covered by Sections 4a-60 and 46a-71(d) of the Connecticut General Statutes.

According to Section 46a-68j-30(9) of the Contract Compliance Regulations, every agency awarding a contract subject to the contract compliance requirements has an obligation to "aggressively solicit the participation of legitimate minority business enterprises as bidders, contractors, subcontractors and suppliers of materials." "Minority business enterprise" is defined in Section 4a-60 of the Connecticut General Statutes as a business wherein fifty-one percent or more of the capital stock, or assets belong to a person or persons: "(1) Who are active in the daily affairs of the enterprise; (2) who have the power to direct the management and policies of the enterprise; and (3) who are members of a minority, as such term is defined in subsection (a) of Section 32-9n." "Minority" groups are defined in Section 32-9n of the Connecticut General Statutes as "(1) Black Americans . . . (2) Hispanic Americans . . . (3) persons who have origins in the Iberian Peninsula . . . (4) Women . . . (5) Asian Pacific Americans and Pacific Islanders; (6) American Indians . . ." An individual with a disability is also a minority business enterprise as provided by Section 4a-60g of the Connecticut General Statutes. The above definitions apply to the contract compliance requirements by virtue of Section 46a-68j-21(11) of the Contract Compliance Regulations.

The awarding agency will consider the following factors when reviewing the bidder's qualifications under the contract compliance requirements:

(a) the bidder's success in implementing an affirmative action plan;
(b) the bidder's success in developing an apprenticeship program complying with Sections 46a-68-1 to 46a-68-17 of the Administrative Regulations of Connecticut State Agencies, inclusive;
(c) the bidder's promise to develop and implement a successful affirmative action plan;
(d) the bidder's submission of employment statistics contained in the “Employment Information Form”, indicating that the composition of its workforce is at or near parity when compared to the racial and sexual composition of the workforce in the relevant labor market area; and
(e) the bidder's promise to set aside a portion of the contract for legitimate minority business enterprises. See Section 46a-68j-30(10)(E) of the Contract Compliance Regulations.

***INSTRUCTIONS:** Bidder must sign acknowledgement below and return acknowledgement to Awarding Agency along with bid proposal.

The undersigned acknowledges receiving and reading a copy of the "Notification to Bidders” form.

_____ _____
Signature Date

On behalf of:

_____
_____
_____

THE FOLLOWING PAGES ARE A SAMPLE COPY OF GREENWICH PUBLIC SCHOOLS OF GREENWICH CONTRACT FOR YOUR REVIEW. YOU MUST BE ABLE TO SIGN THIS CONTRACT AND MEET THE NECESSARY INSURANCE AS REQUIRED BY GREENWICH PUBLIC SCHOOLS OF GREENWICH IN ORDER FOR YOUR PROPOSAL TO BE CONSIDERED.

State of Connecticut
Town of Greenwich
Contract

Town Department: Greenwich Public Schools
Division:

Contract No.:
Account Name:

Name and
Address
Of
Contractor

Account Code
Total Amount
of Contract

This Agreement made this ____ day of _____2026 between Greenwich Public Schools hereafter called the Owner and _____ hereafter called the Contractor

Witnessed as follows:

1. The Contractor agrees to furnish materials and perform services as shown in specifications and contract documents hereto attached and made a part hereof, and consisting of numbered pages from 1 to .
2. The Owner agrees to pay the price designated for such materials and services upon certification by the proper agent of the Owner.
3. This contract shall not be valid until approved by the Town Attorney and countersigned by the Town Comptroller.

GREENWICH PUBLIC SCHOOLS

By_____
I Its Chief Financial & Administrative Officer

CONTRACTOR

By_____
Its

Approved as to legal sufficiency

Date_____ _____
Assistant Town Attorney

I hereby certify that the estimated amount of this contract does not exceed the unencumbered balances of amounts duly appropriated and against which this contract is chargeable as indicated hereon.

Date_____ _____

Comptroller

SERVICE AGREEMENT

#_____

THIS SERVICE AGREEMENT, executed this _____day of _____in the year Two Thousand Twenty-Six (herein referred to as the "Agreement") by and between GREENWICH PUBLIC SCHOOLS, Town of Greenwich, Connecticut, (hereinafter referred to as the "Owner"), acting through _____ hereunto duly authorized, and _____, (hereinafter referred to as "Contractor") acting through _____, duly authorized. Owner and Contractor are sometimes referred to herein individually as a "Party," and collectively as the "Parties."

WITNESSETH, that in consideration of the mutual covenants and agreements herein contained, and for other good and valuable consideration, the parties agree as follows:

1. DEFINITIONS:

Wherever the words hereinafter defined or pronouns used in their stead occur in the Agreement Documents, they shall have the following meaning:

"Contractor" shall mean the person or organization identified as such in this Agreement and shall include its authorized representative.

"Contracting Officer or Agency" shall mean that official of the Owner which awards the contract, executes the Agreement and any Purchase and Supplement Order(s) pursuant to this Agreement, and is the Owner's authorized representative.

"Work" shall mean the provision of equipment and labor to complete Purchase Order.

The Owner's Request for Bid/Proposal No. ____(insert name of Bid Request), annexed hereto as Exhibit ___; the Contractor's Bid and Responses, including all addenda, attached hereto as Exhibit ____; and as accepted by the Owner in its Award Letter, annexed hereto as Exhibit ___; the conditions and specifications contained in this Agreement, and all addenda and amendments to any of the foregoing, collectively constitute the Contract Documents, for a total number of ___ pages, hereinafter referred to as the "Contract."

2. DESCRIPTION OF WORK:

See description of work as noted below. Any additional work is to be performed pursuant to Supplement Order(s) issued referencing the appropriate Contract number.

All work to be performed as per specifications in the Owner's Request for Bid/Proposal No. ____ (insert name of Bid), attached hereto as Exhibit __ , the Contractor's Bid and

Responses, including all addenda, attached hereto as Exhibit__, as accepted by the Owner in its Award Letter, annexed hereto as Exhibit __, and in accordance with the conditions and specifications as set forth in Service Contract #___, and all exhibits, addenda and amendments to this Contract.

3. PAYMENT AND PERIOD:

Base Contract period is:	through	.
First option year is:	through	.
Second option year is:	through	.
Third option year is:	through	.
Fourth option year is:	through	.

The Contractor shall invoice the Owner on a service rendered basis.

Contractor shall send all invoices via electronic mail to accountspayable@greenwich.k12.ct.us. Contractor agrees to accept payment through Electronic Funds Transfer (EFT) via Automatic Clearing House (ACH) for all services rendered. Such payments will be made by the Owner net 30 days after receipt of invoice and acceptance and approval by the Owner, for all services actually rendered. The acceptance by the Contractor of any such payment shall be a release to the Owner of all claims and all liability to the Contractor in connection with the Agreement, arising during the period for which payment is made. No payment, however, shall operate to release the Contractor or its sureties or insurers from any obligation under the Agreement to be entered into or any insurance policies issued in connection with said contract. Payment shall be made on the basis of unit price and/or hourly rate as noted in the Contractor's Bid (attached hereto as Exhibit). The initial contract amount shall be the amount noted on the face sheet of this Agreement. Payment for additional work performed pursuant to Supplement Order(s) shall be in the amount stated on such Supplement Order(s).

4. PERFORMANCE MAINTENANCE AND PAYMENT BOND:

The Contractor shall, simultaneously with the signing of this Agreement, furnish the Owner with the executed Performance, Maintenance and Payment Bond of a surety company authorized to do business in the State of Connecticut, and acceptable to the Owner, in the sum of the full amount of the Contract obligation in the form provided by the Owner.

The above is only required for contracts exceeding $100,000.00.

For contracts that require a Performance, Maintenance and Payment Bond, the Contractor shall maintain all of the specified required insurance coverage and continue to document the specified required insurance coverage for one (1) year after completion of the work of the contract (or other such time as the contract or other agreement requires).

5. CHANGES IN THE WORK AND AFFECT ON BONDS:

It is distinctly agreed and understood that any changes made in the work, or the Drawings, or Specifications (whether such changes increase or decrease the amount thereof or the time required for its performance), or any changes in the manner or time of payments made by the

Owner to the Contractor, or any other modifications of the Contract, shall in no way annul, release, diminish or affect the liability of the surety on the Contract Bonds given by the Contractor, it being the intent hereof that notwithstanding such changes, the liability of the surety on said bonds continue and remain in full force and effect.

Any increase in the Contract amount shall automatically result in a corresponding increase in the Performance, Maintenance and Payment Bond amount. Contractor will obtain, provide, and maintain said increased bond amount, as well as all of the specified required insurance coverage, and continue to document the specified required insurance coverage for one (1) year after completion of the work of the contract (or other such time as the contract or other agreement requires). Decreases in the Contract amount shall not, however, reduce the Bond amount.

6. INSURANCE:

The Contractor shall take out and maintain during the life of this Agreement the types and amounts of insurance as are set forth in the attached Exhibit A. At the time of the signing of this Agreement by the Contractor, the Contractor shall furnish the Owner with a completed certificate of insurance on the Acord form that is referenced in the attached Exhibit A evidencing such coverage.

7. CONTRACTOR AN INDEPENDENT CONTRACTOR:

Contractor shall at all times be deemed to be an independent contractor and shall be wholly responsible for the manner in which it performs the services required of it by the terms of the Agreement. Nothing herein contained shall be construed as creating the relationship of employer and employee or principal and agent, between the Owner, its agencies, employees, agents and Contractor, its employees and agents. Contractor assumes exclusively the responsibility for the acts of its employees and agents as they relate to the services to be provided during the course and scope of their employment. Contractor, its agents and employees shall not be entitled to any rights and privileges of the Owner's employees and shall not be considered in any manner to be employees of the Owner. Contractor, its employees, and its agents, shall not hold themselves out in any manner as being anything but an independent contractor of the Owner and may not use the Owner's name or the Owner's seal for any purpose and in any manner without the express permission of the Owner.

8. STANDARD OF OBLIGATION AND SERVICE:

Any conflict between this Agreement and any Invitation To Bid, Request For Proposal, Bid or response to Request For Proposal, including any accompanying addenda, shall be resolved in favor of this Agreement, with the exception that any provision in any Invitation To Bid, Request For Proposal, Bid or response to Request For Proposal, or accompanying addenda, that is attached as an Exhibit to this Agreement, which Exhibit provides for a higher standard of obligation or service by Contractor, shall control as to the standard of obligation and service required of the Contractor and shall thereby supplement this Agreement.

9. TERMINATION:

The Owner may at any time and for any reason terminate this Agreement by written notice specifying the termination date, which shall be not less than seven (7) days from the date such notice is given. Termination under this section shall not give rise to any claim against the Owner for damages for compensation in addition to that provided hereunder.

10. DEFECTIVE WORK:

The inspection of the Work shall not relieve the Contractor of any of his obligations to perform and complete the Work as required by the Agreement. Defective work shall be corrected and unsuitable materials, equipment apparatus and other items shall be replaced by the Contractor, notwithstanding that such work, materials, equipment, apparatus and other items may have been previously overlooked or accepted or estimated for payment.

11. CONTRACT EXTENSION:

If the Contractor has been delayed and as a result will be unable, in the opinion of the Owner, to complete performance fully and satisfactorily within the time allowed herein, the Contractor, upon submission of evidence of the cause of the delay satisfactory to the Owner, shall at the discretion of the Owner, be granted an extension of time for performance equal to the period that the Contractor was actually and necessarily delayed.

12. GUARANTEE:

The Contractor guarantees that the work and services to be performed under the Agreement and all workmanship, materials and equipment performed, furnished, used or installed in the construction of the same, shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the drawings, specifications, and other contract documents, that the strength of all parts of all manufactured equipment shall be adequate and as specified and that the performance test requirements of the contract shall be fulfilled. This guarantee shall be for a period of one year from and after the date of completion and acceptance of the work as stated in the final estimate. The Contractor shall repair, correct or replace as required, promptly and without charge, all work, equipment and materials, or parts thereof, which fail to meet the above guarantee or which in any way fail to comply with or fail to be in strict accordance with the terms and provisions and requirements of the Agreement during such one-year period, and also shall repair, correct or replace all damage to the work resulting from such failure.

If the manufacturer's warranty for equipment and materials installed is greater than the one-year period for warranty specified above, the warranty will be passed through to the Owner. Upon completion of the project by the Contractor and acceptance by the Owner, all warranties will be passed through to the Owner and all paperwork turned over to the Owner.

13. COMPLIANCE WITH LAWS:

Contractor represents that it is authorized to do business in the State of Connecticut. The Contractor shall keep fully informed of all existing and future federal, state and local laws, ordinances, rules and regulations affecting those engaged or employed on the work, the materials and equipment used in the work or the conduct of the work, and of all orders, decrees and other requirements of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the Specifications or other Contract documents in relation to any such law, ordinance, rule, regulation, order, decree or other requirement, the Contractor shall forthwith report the same to the Owner in writing. The Contractor shall at all times observe and comply with, and cause all its agents, servants, employees and subcontractors to observe and comply with all such existing and future laws, ordinances, rules, regulations, orders, decrees and other requirements, and it shall protect, indemnify and save harmless the Owner, its officers, agents, servants and employees from and against any and all claims, demands, suits proceedings, liabilities, judgments, penalties, losses, damages costs and expenses, including attorneys' fees, arising from or based upon any violation or claimed violation of any such law, ordinance, rule, regulation, order, decree or other requirement, whether committed by the Contractor or any of its agents, servants, employees or subcontractors.

14. INDEMNITY:

The Contractor shall indemnify and save harmless the Owner and its officers, agents, servants and employees, from and against any and all claims, demands, suits, proceedings, liabilities, judgments, awards, losses, damages, costs and expenses, including attorneys' fees, on account of bodily injury, sickness, disease or death sustained by any person or persons or injury or damage to or destruction of any property, directly or indirectly arising out of, relating to or in connection with the Work, whether or not due or claimed to be due in whole or in part to the active, passive or concurrent negligence or fault of the Contractor, its officers, agents, servants or employees, any of its subcontractors, the Owner, any of its respective officers, agents, servants or employees and/or any other person or persons, and whether or not such claims, demands, suits or proceedings are just, unjust, groundless, false or fraudulent. Contractor shall and does hereby assume and agrees to pay for the defense of all such claims, demands, suits and proceedings, provided that the Contractor shall not be required to indemnify the Owner, its officers, agents, servants or employees against any such damages occasioned solely by acts or omissions of the Owner other than supervisory acts or omissions of the Owner in connection with the Work.

The insurance requirements contained in this Contract establish minimum insurance requirements only and shall not constitute, or be construed as, a limitation, cap, or ceiling on the Contractor's liability or obligations. The Contractor shall be responsible for the full amount of any liability, loss, damage, claim, judgment, cost or expense for which the Contractor is legally or contractually responsible, notwithstanding the existence, availability, adequacy, or limits of any insurance maintained by the Contractor.

15. CLAIMS FOR DAMAGES:

If the Contractor makes claim for any damages alleged to have been sustained by breach of contract or otherwise, it shall, within ten (10) days after occurrence of the alleged breach or within ten (10) days after such damages are alleged to have been sustained whichever date is the earlier, file with the Contracting Officer a written, itemized statement of the details of the alleged breach and the details and amount of the alleged damages. The Contractor agrees that unless such statement is made and filed as so required, its claim for damages shall be deemed waived, invalid, and unenforceable, and that it shall not be entitled to any compensation for any such alleged damages. Within ten (10) days after the timely filing of such statement, the Contracting Officer shall file with the appropriate department of the Owner, one copy of the statement, and shall file with the Owner and the Contractor his determination thereon. The Contractor shall not be entitled to claim any additional compensation for damages by reason of any direction, instruction, determination or decision of the Owner or its agents, nor shall any such claims be considered, unless the Contractor shall have complied in all respects with the provisions of this paragraph.

16. ABANDONMENT OF THE WORK OR OTHER DEFAULT:

If the Work shall be abandoned, or any part thereof shall be sublet without previous written consent of the Owner, or the Agreement or any moneys payable hereunder shall be assigned otherwise than as herein specified, or if at any time the Contracting Officer shall be of the opinion, and shall so certify in writing, that the conditions herein specified as to rate of progress are not being complied with, or that the Work or any part thereof is being unnecessarily or unreasonably delayed, or that the Contractor has violated or is in default under any of the provisions of the Agreement, or if the Contractor becomes bankrupt or insolvent or goes or is put into liquidation or dissolution, either voluntarily or involuntarily, or petitions for an arrangement or reorganization under the Bankruptcy Act, or makes a general assignment for the benefit of creditors or otherwise acknowledges insolvency, the happening of any of which shall be and constitute a default under the Agreement, the Owner may notify the Contractor in writing, with a copy of such notice mailed to the surety, to discontinue all Work or any part thereof; thereupon the Contractor shall discontinue such Work or such part thereof as the Owner may designate; and the Owner may, upon giving such notice, by Agreement or otherwise as it may determine, complete the Work or such part thereof and charge the entire cost and expense of so completing the work. The Owner shall be entitled to reimbursement from the Contractor and the Contractor agrees to pay to the Owner any losses, damages, costs and expenses, including attorneys' fees, sustained or incurred by the Owner by reason of any of the foregoing causes. For the purpose of such completion the Owner may for itself or for any Contractors employed by the Owner take possession of and use or cause to be used any and all materials, equipment, plant, machinery, appliances, tools, supplies and such other items of every description that may be found or located at the site of the Work.

All costs, expenses, losses, damages, attorneys' fees, and any and all other charges incurred by the Owner under this subsection shall be charged against the Contractor and deducted and/or paid by the Owner out of any moneys due and payable or to become due or payable under the Agreement to the Contractor. In computing the amounts chargeable to the Contractor, the

Owner shall not be held to a basis of the lowest prices for which the completion of the Work or any part thereof might have been accomplished, but all sums actually paid or obligated therefor to affect its prompt completion shall be charged to and against the account of the Contractor. In case the costs, expenses, losses, damages, attorneys' fees and other charges together with all payments theretofore made to or for the account of the Contractor are less than the sum which would have been payable under the Agreement if the Work had been properly performed and completed by the Contractor, the Contractor shall be entitled to receive the difference, and, and in case such costs, expenses, losses, damages, attorneys' fees and other charges, together with all payments theretofore made to or for the account of the Contractor, shall exceed the said sum, the Contractor shall pay the amount of the excess to the Owner.

17. **LIABILITY OF OWNER:**

No person, firm or corporation, other than the Contractor, who signed this Agreement, shall have any interest herein or rights hereunder. No claim shall be made or be valid either against the Owner or any agent of the Owner and neither the Owner nor any agent of the Owner shall be liable for or be held to pay any money except as herein provided.

18. CLAIMS:

If at any time there be any evidence of any claims for which the Contractor is or may be liable or responsible hereunder, the Contractor shall promptly settle or otherwise dispose of the same, and until such claims are settled or disposed of, the Owner may retain from any moneys which would otherwise be payable hereunder so much thereof as, in its sole judgment, it may deem necessary to settle or otherwise dispose of such claims and to pay the costs and expenses, including attorneys' fees, of defending any actions brought to enforce such claims or incurred in connection therewith or by reason thereof.

19. PROVISIONS REQUIRED BY LAW DEEMED INSERTED:

Each and every provision of law and clause required by law to be inserted in the Agreement shall be deemed to be inserted herein, and the Agreement shall be read and enforced as though they were included herein. If through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Agreement shall forthwith be physically amended to make such insertion.

20. **PERMITS:**

The Contractor shall, at its own expense, take out and maintain all necessary permits from the State, Town, or other public authorities; shall give all notices required by law; and shall post all bonds and pay all fees and charges incident to the due and lawful prosecution of the Work.

21. NOT TO SUBLET OR ASSIGN:

The Contractor shall constantly give his personal attention to the faithful prosecution of the Work, shall keep the same under his personal control, shall not assign the Agreement or

sublet the Work or any part thereof without the previous written consent of the Owner, and shall not assign any of the moneys payable under the Agreement, or his claim thereto, unless by and with the like written consent of the Owner. Any assignment or subletting in violation hereof shall be void and unenforceable.

22. EMPLOY COMPETENT PEOPLE:

The Contractor shall employ only competent people on the Work and shall not employ people or means which may cause strikes, work stoppages and/or disturbances by workmen employed by the Contractor, any subcontractor, the Owner, the Contracting Officer or any other contractor. Whenever the Contracting Officer notifies the Contractor in writing that in his opinion any person on the Work is incompetent, unfaithful, disorderly, or otherwise unsatisfactory or not employed in accordance with the provisions of the Agreement, such person shall be discharged from the Work and shall not again be employed on it, except with the written consent of the Contracting Officer.

23. EMPLOY SUFFICIENT LABOR AND EQUIPMENT:

If in the sole judgment of the Contracting Officer the Contractor is not employing sufficient labor, plant, equipment, or other means to complete the Work within the time specified, the Contracting Officer may, after giving written notice, require the Contractor to employ such additional labor, plant, equipment and other means as the Contracting Officer deems necessary to enable the Work to progress properly.

24. PREVAILING WAGE RATES; CONSTRUCTION SAFETY AND HEALTH COURSE:

Except as noted below, the Contractor shall comply with the current provisions of Section 31-53 of the General Statutes of the State of Connecticut, a part of which is quoted as follows:

"The wages paid on an hourly basis to any mechanic, laborer or workman employed upon the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such employee to any employee or welfare fund, as defined in subsection (H) of section 31-53 of the General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the Town in which such public works project is being constructed. Any Contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wages the amount of payment or contribution for his classification on each pay day."

The provisions of this section shall not apply where the total cost of all work to be performed by all Contractors and subcontractors in connection with new construction of any public works project is less than one million dollars ($1,000,000.00) or where the total cost of all work to be performed by all contractors and subcontractors in connection with any remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public project is less than one hundred thousand dollars ($100,000.00).

All Contractors and subcontractors shall submit certified weekly payrolls, on forms furnished by the Owner, for all contracts meeting the aforementioned monetary limits. The certified payrolls shall be submitted with the Contractor's monthly certificate for payment.

Section 31-55a of the General Statutes of the State of Connecticut provides that the prevailing wage rates applicable to any awarded contract or subcontract are subject to annual adjustments each July 1st for the duration of the project.

Each Contractor that is awarded a contract 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.ctdol.state.ct.us. For those without internet access, contact the division listed below.

The Contractor shall also furnish proof with the weekly certified payroll for the first week each employee begins work that any person performing the work of a mechanic, laborer or worker has completed a course of at least ten (10) hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration in accordance with Connecticut General Statutes Section 31-53b and regulations adopted by the State of Connecticut Labor Commissioner.

Questions can be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at 860-263-6790.

25. <u>NONDISCRIMINATION AND AFFIRMATIVE ACTION:</u>

(A) (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, sexual orientation, intellectual disability, mental disability 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. The Contractor further agrees to take affirmative action to insure that applicants with job-related qualifications are employed and that employees are treated when employed without regard to race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability 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; (2) the Contractor agrees, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, to

state that it is an "affirmative action-equal opportunity employer," in accordance with regulations adopted by the Commission; (3) the Contractor agrees to provide each labor union or representative of workers with which such Contractor has a collective bargaining agreement or other contract or understanding and each vendor with which such Contractor has a contract or understanding, a notice to be provided by the commission advising the labor union or workers' representative of the Contractor's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (4) the Contractor agrees to comply with each provision of this section and sections 46a-68e and 46a-68f and with each regulation or relevant order issued by said Commission pursuant to sections 46a-56, 46a-68e, 46a-68f and 46a-86; (5) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information as requested by the Commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor as they relate to the provisions of this section and section 46a-56.

(B) Any Contractor who is a party to a municipal public works contract or quasi-public agency project, where any such contract is valued at less than $50,000 for each year of the contract, shall provide the Commission on Human Rights and Opportunities with a written or electronic representation that complies with the nondiscrimination agreement and warranty under subsection (A)(1) above, provided if there is any change in such representation, the Contractor shall provide the updated representation to the Commission not later than 30 days after such change. Any Contractor who is a party to a municipal public works contract or a quasi-public agency project, where any such contract is valued at $50,000 or more for any year of the contract, shall provide the Commission with any one of the following: (1) Documentation in the form of a company or corporate policy adopted by resolution of the board of directors, shareholder, managers, members or other governing body of such Contractor, that complies with the nondiscrimination agreement and warranty under subsection (A)(1) of this section; (2) Documentation in the form of a company or corporate policy adopted by a prior resolution of the board of directors, shareholders, managers, members or other governing body of such contractor if (a) the prior resolution is certified by a duly authorized corporate officer of such contractor to be in effect on the date the documentation is submitted, and the executive director of the Commission on Human Rights and Opportunities or designee certifies that the prior resolution complies with the nondiscrimination agreement and warranty under subdivision (A)(1) of this section; or (3) Documentation in the form of an affidavit signed under penalty of false statement by a chief executive officer, president, chairperson or other corporate officer duly authorized to adopt company or corporate policy that certifies that the company or corporate policy of the contractor complies with the nondiscrimination agreement and warranty

under subdivision (A)(1) of this section and is in effect on the date the affidavit is signed.

(C) If the Contract is a municipal public works contract or a quasi-public agency project, the Contractor agrees and warrants that s/he will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on such public works project. The Contractor shall include the provisions of subdivision (A)(1) of this section in every subcontract or purchase order entered into to fulfill any obligation of a municipal public works contract or contract for a quasi-public agency project, and such provisions shall be binding on a subcontractor, vendor or manufacturer, unless exempted by regulations or orders of the Commission on Human Rights and Opportunities. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions, including sanctions for noncompliance in accordance with section 46a-56; provided, if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission regarding a state contract, the Contractor may request the state of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the state and the state may so enter.

(D) "Minority business enterprise" means any small contractor or supplier of materials fifty-one per cent or more of the capital stock, if any, or assets of which is owned by a person or persons: (1) Who are active in the daily affairs of the enterprise, (2) who have the power to direct the management and policies of the enterprise and (3) who are members of a minority, as such term is defined in subsection (a) of section 32-9n; and "good faith" means that degree of diligence which a reasonable person would exercise in the performance of legal duties and obligations. "Good faith efforts" shall include, but not be limited to, those reasonable initial efforts necessary to comply with statutory or regulatory requirements and additional or substituted efforts when it is determined that such initial efforts will not be sufficient to comply with such requirements. Determination of the Contractor's good faith efforts shall include, but shall not be eliminated to, the following factors: The Contractor's employment and subcontracting policies, patterns and practices; affirmative advertising recruitment and training; technical assistance activities and such other reasonable activities or efforts as the Commission on Human Rights and Opportunities may prescribe that are designed to ensure the participation of minority business enterprises in municipal public works contracts or quasi-public agency projects. "Municipal public works project" means that portion of an agreement entered into on or after October 1, 2015, between any individual, form or corporation and a municipality for the construction, rehabilitation, conversion, extension, demolition or repair of a public building, highway or other changes or improvements in real property, which is financed in whole or in part by the state, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees but excluding any project of an alliance district, as defined in section 10-262u, finance by the state funding in an amount equal to

fifty thousand dollars or less. "Quasi-public agency project" means the construction, rehabilitation, conversion, extension, demolition or repair of a building or other changes or improvements in real property pursuant to a contract entered into on or after October 1, 2015, which is financed in whole or in part by a quasi-public agency using state funds, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees.

THE ABOVE REQUIREMENT ONLY APPLIES TO PUBLIC WORKS CONTRACTS EXCEEDING $50,000 AND RECEIVING STATE OF CONNECTICUT FUNDING.

26. PAYMENT OF SUBCONTRACTORS:

As required by Section 49-41a of the Connecticut General Statutes, within thirty (30) days after payment to the Contractor by the Owner for work under this Agreement, the Contractor shall pay any amount due any subcontractor, whether for labor performed or materials furnished when such labor or materials have been included in a requisition submitted by such Contractor and paid by the Owner.

The general contractor shall include in each of its subcontracts, a provision requiring each subcontractor to pay any amounts due any if its subcontractors, whether for labor performed or materials furnished, within thirty days after such subcontractor receives a payment from the general contractor which encompasses labor, or materials furnished by such subcontractor.

27. NON-CONNECTICUT CONTRACTORS

THE FOLLOWING IS NOT REQUIRED FOR REPAIR WORK. THE FOLLOWING ONLY APPLIES TO CONTRACTORS LOCATED IN STATES OTHER THAN CONNECTICUT AND FOR PROJECTS INVOLVING RENOVATION OR NEW WORK.

In the event a service agreement is established between the Owner and a non-Connecticut contractor and renovation work or new work is required, the following procedure shall be followed:

a. The nonresident contractor shall provide the Owner with a written quotation in the full amount of the project.

b. Upon approval of the quotation by the Owner, the Owner will issue a purchase order if needed and the following shall be followed:

c. Pursuant to Connecticut General Statutes § 12-430(7), as amended by Public Act No. 03-147 (An Act Concerning Sales Tax Bond Requirements for Nonresident Contractors) and Public Act No. 03-6 (An Act Concerning General Budget and Revenue Implementation), Sec.76, a nonresident contractor shall furnish the Department of Revenue Services (DRS) a guarantee bond for 5% of the total amount of the purchase order using Form AU-766, copy attached. This form is also available on the State's web site,
http://www.ct.gov/drs/cwp/view.asp?a=1509&q=270990&drsPNavCtr=|#41307

The nonresident contractor must have completed and submitted to the DRS Form REG-1, *Business Taxes Registration Application,* to register with the DRS and have been issued a Connecticut Tax Registration Number. A copy of this form is attached. This form is also available on the State's web site, **http://www.ct.gov/drs/cwp/view.asp?a=1509&q=266240**, for the purpose of online registration.

The nonresident contractor has 120 days from the commencement of the contract to file the guarantee bond. As soon as the guarantee bond is filed with the DRS, a copy of such guarantee bond together with the nonresident contractor's Connecticut Tax Registration Number shall be submitted to the department that issued the purchase order/change order/supplement by the nonresident contractor

After the nonresident contractor receives a Certificate of Compliance from the DRS confirming that the guarantee bond requirement has been met, the nonresident contractor shall submit a copy of said form, referencing the service agreement, to the department that issued the purchase order/change order/supplement.

If the copy of the Certificate of Compliance is not received by the department that issued the purchase order within 120 days from the commencement of the purchase order, the Owner will be obligated under law to withhold payment in the amount of 5% of the purchase order total, including the price of all add-ons, and remit the amount as a deposit to the DRS not later than 30 days after the completion of the purchase order.

The Owner will also be obligated to withhold 5% from each contractor's invoice if the contractor has invoiced the Owner before 120 days from the commencement of the purchase order and has not supplied the Owner with a copy of the Certificate of Compliance.

This procedure shall be followed each time renovation work or new work is ordered based on a service agreement with a nonresident contractor.

28. INTOXICATING LIQUORS:

The Contractor shall not sell and shall neither permit nor suffer the introduction or use of intoxicating liquors upon or about the Work.

29. ACCESS TO WORK:

The Owner, the Contracting Officer, and their officers, agents, servants and employees may at any and all times and for any and all purposes, enter upon the Work and the site thereof and the premises used by the Contractor, and the Contractor shall at all times provide safe and proper facilities therefor.

30. EXAMINATION OF WORK:

The Contracting Officer shall be furnished by the Contractor with every reasonable facility for examining and inspecting the Work and for ascertaining that the Work is being

performed in accordance with the requirements and intent of the Agreement, even to the extent of requiring the uncovering or taking down portions of finished work by the Contractor.

31. PRICES FOR WORK:

The Owner shall pay and the Contractor shall receive the prices stipulated in the pricing schedule of the Contractor's Bid (attached hereto as Exhibit) made a part hereof as full compensation for everything performed and furnished and for all risks and obligations undertaken by the Contractor under and as required by the Agreement, for the base contract period. When applicable, the pricing schedule established in the Bid for subsequent option years shall be implemented upon mutual written agreement of both parties to extend the term of the Service Agreement for additional one-year increments.

32. EXTRA WORK:

The Contractor shall perform any extra work (work in connection with the Contract but not provided for herein) when and as ordered in writing by the Contracting Officer, at the unit prices stipulated in the Contract for such work or, if none are so stipulated, either (a) at the price agreed upon before such work is commenced and named in the written order for such work, or (b) if the Contracting Officer so elects, for the reasonable cost of such work, as determined by the Contractor and approved by the Contracting Officer, plus a percentage of such cost, as may be agreed upon by Contract and Contracting Officer.

33. CHANGES:

The Owner, through its designated Agent, may make changes in the Work and in the Drawings, if any, and Specifications by making alterations therein, additions, thereto or omissions therefrom. All work resulting from such changes shall be performed and furnished under and pursuant to the terms and conditions of the Contract. If such changes result in an increase or decrease in the Work to be done hereunder, or increase or decrease the quantities thereof, adjustment in compensation shall be made. For eliminated or decreased work, the Contractor shall allow the Owner a reasonable credit as determined by the Owner. Except in an emergency endangering life or property, no change shall be made unless pursuant to a written order from the Owner authorizing the change, and no claim for additional compensation shall be valid unless the change is so ordered by the Owner.

The Contractor agrees that it shall neither have nor assert any claim for or be entitled to any additional compensation for damages or for loss of anticipated profits on work that is eliminated.

34. MONEYS MAY BE RETAINED:

The Owner may at any time retain from any moneys which would otherwise be payable hereunder so much thereof as the Owner may deem necessary to complete the Work hereunder and to reimburse it for all costs, expenses, losses, and damaged chargeable to the Contractor hereunder.

35. USE OR PARTIAL PAYMENT NOT ACCEPTANCE:

It is agreed that this is an entire contract for one whole and complete Work or result and that neither the Owner's entrance upon or use of the Work or any part thereof nor any partial payments by the Owner shall constitute an acceptance of the Work or any part thereof before its entire completion and final acceptance.

36. PATENTS:

The Contractor shall indemnify and save harmless the Owner and all persons acting for or on behalf of the Owner from all claims and liability of any nature or kind, and all damages, costs and expenses, including attorneys' fees, arising from or occasioned by an infringement or alleged infringement of any patents or patent rights on any invention, process, materials, equipment, article, or apparatus, or any part hereof, furnished and installed by the Contractor, or arising from or occasioned by the use or manufacture thereof, including their use by the Owner.

37. LIENS:

If at any time any notices of lien or other legal process are filed for labor performed or materials or equipment manufactured, furnished, or delivered to or for the Work, the Contractor shall, at its own cost and expense, promptly discharge, remove or otherwise dispose of the same, and until such discharge, removal or disposition, the Owner shall have the right to retain from any moneys payable hereunder an amount which, in its sole judgment, it deems necessary to satisfy such liens and pay the costs and expenses, including attorneys' fees, of defending any actions brought to enforce the same, or incurred in connection therewith or by reason thereof.

38. ENTIRE AGREEMENT:

This Agreement, including any referenced exhibits, constitutes the entire agreement between the Parties. No modification, amendment, or waiver of any provision of this agreement will be effective unless in writing and signed by both parties hereto. This Agreement represents the entire understanding between the parties and supersedes and replaces all other agreements related to this subject matter.

39. GOVERNING LAW:

The laws of the State of Connecticut shall govern this Contract and any and all litigation related to this Contract. In the event of litigation related to this Contract, the exclusive forum shall be the State of Connecticut and the exclusive venue for such litigation shall be the Judicial District for Stamford/Norwalk at Stamford

40. WAIVER:

No delay or failure by either party to exercise any right or power under this Contract will constitute a waiver of that right. A waiver by any party of any of the covenants, conditions, or agreements to be performed by the other party or any breach thereof will not be construed to be a waiver of any succeeding breach thereof or of any other covenant, condition, or agreement herein

contained. No change, waiver, or discharge hereof will be valid unless in writing and signed by an authorized representative of the party against which such change, waiver, or discharge is sought to be enforced.

41. FOIA:

Contractor acknowledges that Owner is subject to the Connecticut Freedom of Information Act ("FOIA"). No information provided to Owner by Contractor or any Subcontractor, shall be considered confidential, irrespective of any representation to the contrary, with the exception of the provisions contained in C.G.S. §1-210(b). Contractor agrees that they will comply with any and all FOIA requests placed upon the Owner that involve this Contract and any work conducted in relation thereto. The Owner shall have full authority as to whether it will invoke an exemption to a FOIA request. In no event shall Owner have any liability for the disclosure of documents or information in its possession which Owner believes it is required to disclose pursuant to FOIA or any other law.

42. SEVERABILITY:

If any provision of this Agreement is declared or found to be prohibited, unenforceable or void, the Parties will negotiate in good faith to agree upon a substitute provision that is valid, binding, and enforceable and as nearly as possible consistent with the intentions underlying the original provision. If the Parties are unable to agree upon such substitute provision, the original provision will be stricken. If the remainder of this Agreement is not materially affected by such declaration or finding and is capable of substantial performance, then the remainder shall be enforced to the extent permitted by law.

43. COUNTERPARTS/ELECTRONIC SIGNATURES:

The parties may execute this Agreement in multiple counterparts, each of which constitutes an original as against the party that signed it, and all of which together constitute one agreement. The signatures of all parties need not appear on the same counterpart. The delivery of signed counterparts by facsimile, email or other electronic transmission that includes a copy of the sending party's signature is as effective as signing and delivering the counterpart in person. The parties may affix their signatures electronically to this Contract by typing their names on the signature lines below ("Electronic Signature"). A party who executes this Agreement by electronic signature agrees such signature is the legal equivalent to a hand-written signature on this Agreement, which shall have the same binding legal effect as if the party had personally signed his or her name to paper.

44. EMPLOYEE BACKGROUND SCREENING:

Contractor is required to perform Employee Background Screening as imposed by Section 2 of the Public Act 16-67, which amended Conn. Gen. Stat. section 10-222c. All signed and completed background checks are to be submitted to Greenwich Public Schools via secure email link: background_department@greenwich.k12.ct.us

45. ARTIFICIAL INTELLIGENCE

Definition of Artificial Intelligence.
For purposes of the following provisions, "Artificial Intelligence" or "AI" means any machine-based system, software, application, algorithm, model, large language model, generative AI system, machine-learning technology, automated decision-making system, or other technology that, for explicit or implicit objectives, generates outputs including predictions, recommendations, decisions, classifications, content, analyses, or other information that may influence or perform functions on behalf of the Town.

Disclosure and Prior Approval of AI Use.
Contractor shall not use, deploy, access, or permit any Artificial Intelligence technology in connection with the performance of Services without the Town's prior written approval. Contractor shall provide the Town, upon request and prior to implementation, with sufficient information regarding the proposed AI technology to permit the Town to evaluate the associated legal, operational, privacy, cybersecurity, civil rights, financial, and other risks.

Compliance With Law.
Contractor shall comply with all applicable federal, state, and local laws, regulations, ordinances, rules, and legally binding governmental requirements, including, but not limited to, those relating to Artificial Intelligence, privacy, cybersecurity, data protection, discrimination, civil rights, employment, public records, accessibility, intellectual property, and consumer protection.

Dated at Greenwich, Connecticut,

GREENWICH PUBLIC SCHOOLS

TOWN OF GREENWICH

By_____

Its_____

THE CONTRACTOR

By:_____

Its:_____

EXHIBIT A

Insurance Requirement Sheet

Insurance Requirements: Before starting and until final completion and acceptance of the work called for in the Contract and expiration of the guarantee period provided for in the Contract, the Contractor and its subcontractors, if any, shall procure and maintain insurance of the types and amounts checked in paragraphs A through F below for all Contract operations. If any of the required insurance is on a claims made basis and does not include an extended reporting period of at least 36 months, contractor shall maintain either tail coverage or continuous claims made liability coverage, provided the effective date of the continuous claims made coverage is on or before the effective date of the contract with the Town, for a minimum of months following the later of (i) contractor's completion and Town's acceptance of all services required under the contract, or, (ii) Town or contractor termination of contract, or, (iii) the expiration of the claims made policy. The Town of Greenwich shall be given thirty (30) days prior written notice of cancellation, lapse or restrictive amendment (except ten days' notice of nonpayment) of the policies listed in the Acord form.

☒ A. General Liability, with minimum coverages for combined bodily injury and property damage liability of $2,000,000 Aggregate and $1,000,000 per occurrence including:

☒ 1. Commercial General Liability which meets or exceeds the coverage in Commercial General Liability ISO Form CG 00011001 or CG 00010413, including contractual liability.

☒ 2. Town of Greenwich, Greenwich Public Schools, The Greenwich Board of Education _____ as additional insured. Contractor's insurance must be primary and non-contributory – and stated as such in the Description of Operations section of the Acord form.

☐ 3. Owners and Contractors Protective Liability (separate policy in the name of the Town).

☒ B. Comprehensive Automobile Liability, with minimum coverages of $1,000,000 combined single limit for bodily injury and property damage, including, where applicable, coverage for any vehicle, all owned vehicles, scheduled vehicles, hired vehicles, non-owned vehicles and garage liability.

☒ C. Excess Liability, with minimum coverage of $5,000,000 in umbrella form, or such other form as approved by Town Department Head and Risk Management Director.

☒ D. Workers' Compensation and Employer's Liability, with minimum coverages as provided by Connecticut State Statutes.

☐ E. Professional Liability (for design and other professionals for Errors and Omissions), with minimum coverage of $1,000,000. If the policy is on a claims-made basis, coverage shall be continually renewed or extended for three (3) years after work is completed under the Contract.

☐ F. Other:_____.

☒ G. CERTIFICATE HOLDER:
Greenwich Public Schools
(Also indicate on Acord Certificate of Insurance)
290 Greenwich Avenue, Greenwich, CT 06830.

The Description of Operations on the Acord certificate of insurance must state the Project Name, the Contract Number and the following: "Town of Greenwich, Greenwich Board of Education and Greenwich Public Schools and _____ is additional insured, Contractor's insurance is primary and non-contributory, General Liability coverage meets or exceeds the coverage in Commercial General Liability ISO Form CG 00 01 10 01, or CG 00 01 04 13, including contractual liability. Town of Greenwich will be given 30 days prior written notice of cancellation, lapse or restrictive amendment (except 10 days' notice of non-payment) of the policies listed on the Acord form."

The Acord certificate of insurance form must be executed by your insurance agent/broker. The most current Acord form should be used. Company name and address must conform on all documents including insurance documentation. List the individual insurance companies, rather than the insurance group, on the Acord form. Check the appropriate box to indicate Town of Greenwich, Greenwich Board of Education and Greenwich Public Schools and_____ are endorsed as an additional insured. Contract development will begin upon receipt of complete, correct insurance documentation.

The Contractor shall be responsible for maintaining the above insurance coverages in force to secure all of the Contractor's obligations under the Contract with an insurance company or companies with an AM Best Rating of A-:VII or better, licensed to write such insurance in Connecticut and acceptable to the Risk Manager, Town of Greenwich. For excess liability only, non-admitted insurers are acceptable, provided they are permitted to do business through Connecticut excess line brokers per listing on the current list of Licensed Insurance Companies, Approved Reinsurers, Surplus Lines Insurers and Risk Retention Groups issued by the State of Connecticut Insurance Department.

(SAMPLE ENDORSEMENT LETTER) **Exhibit A**

AGENT/BROKER

(LETTERHEAD)

(Date)

Eugene H. Watts, Manager of School Procurement
Purchasing Department
Greenwich Public Schools
290 Greenwich Avenue
Greenwich, CT 06830

Greenwich Public Schools **Contract #_____**

Dear Mr. Watts:

The undersigned hereby certifies as follows:

(1) I am a duly licensed insurance agent under the laws of the State of **[insert State]** and an authorized representative of all companies affording coverage under the Acord form submitted herewith;

(2) The Town of Greenwich, The Greenwich Board of Education, Greenwich Public Schools and _____ have been endorsed as an additional insured under the general liability policy no. [insert policy number], issued by **[insert company affording coverage] to [name of insured]**;

(3) The general liability policy referenced in paragraph (2) above meets or exceeds the coverage in Commercial General Liability ISO form CG 00 01 10 01, including contractual liability;

(4) The policies listed in the Acord form submitted to the Town of Greenwich in connection with the above-referenced contract have been issued to the insured in the amounts stated and for the periods indicated in the Acord form; and

(5) The Town of Greenwich shall be given thirty (30) days prior written notice of cancellation, lapse or restrictive amendment (except ten days' notice of nonpayment) of the policies listed in the Acord form.

Sincerely,

Authorized Representative for all companies listed in the Acord form

ACORD **CERTIFICATE OF LIABILITY INSURANCE**

PRODUCER	THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER, THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.
	INSUREERS AFFORDING COVERAGE
INSURED Contract #	INSURER A: INSURER B: INSURER C: INSURER D: INSURER E:

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OF CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE(MM/DD/YY)	POLICY EXPIRATION DATE(MM/DD/YY)	LIMITS
	GENERAL LIABILITY COMMERCIAL GENERAL LIABILITY ☐ CLAIMS MADE ☒ OCCUR ☐_____ ☐_____ GENERAL AGGREGATE LIMIT APPLIES ☐ POLICY ☐PROJECT ☐ LOC				EACH OCCURENCE FIRE DAMAGE (Any one fire) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGRREGATE PRODUCTS-COMP/OP AGG
	AUTOMOBILE LIABILITY ☐ ANY AUTO ALL OWNED AUTOS ☐ SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS ☐_____ ☐				COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)
	GARAGE LIABILITY ☐ ANY AUTO ☐				AUTO ONLY-EA ACCIDENT OTHER THAN EA ACC AUTO ONLY: AGG
	EXCESS LIABILITY ☐ OCCUR ☐ CLAIMS MADE ☐ DEDUCTIBLE ☐ RETENTION $				EACH OCCURRENCE AGGREGATE
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				WC STATU- OTH-ER E.L. EACH ACCIDENT E.L. DISEASE-EA EMPLOYEE E.L. DISEASE – POLICY LIMIT
	Professional Liability				

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

The Town of Greenwich The Greenwich Board of Education, Greenwich Public Schools and _____are named as additional insured for Contract # _____. It is agreed by both parties to Contract No ____ that the Contractors insurance will be primary and non-contributory

CERTIFICATE HOLDER	X	ADDITIONAL INSURED; INSURER LETTER: __	CANCELLATION
Certificate Holder: **Greenwich Public Schools/Purchasing Dept** **290 Greenwich Avenue** **Greenwich, CT 06830**			SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OF REPRESENTATIONS

(To be submitted in duplicate)

BIDDER: _____
Name

_____
Address

To: **Greenwich Public Schools**
290 Greenwich Avenue
Greenwich, CT 06831

Project: **Eastern Middle School Secure Entrance**
51 Hendrie Avenue
Greenwich, CT 06878
Bid #2588-26

In preparing this bid, we have carefully examined the Bidding Documents for this Project. We have visited the site and noted the conditions affecting the Work.

The Bidding Documents referred to include Drawings and Project Manual dated November 10, 2026, prepared by Silver/Petrucelli + Associates, Inc., Hamden, Connecticut.

We propose to perform the work described in the Bidding Documents, in keeping with definitions of Article 1 of the Instructions to Bidders, for the Base Bid Sum as follows:

Base Bid:

Entire Project for the Total Cost of:

$ _____ Dollars ($ .00).
written figure

We will commence work on the project _____ calendar days after receipt of "Notice to Proceed" or signing of Contract, whichever is sooner. We will be able to substantially complete the project within _____ calendar days thereafter.

Unit Prices:

As required by the Base Bid, should deteriorated or damaged materials be required to be removed as determined by the Architect or Owner, the cost to remove and replace the referenced material, (or credit for specified material not provided or installed) including all labor, material, equipment, and related furnishings is as follows:

Item	Description	Unit Price
1.	Small containment preparation containment (less than 160 square/260 linear feet of asbestos-containing material) Pricing for containments with larger amounts of materials are to be INCLUDED in the unit prices themselves listed below. There is no separate unit price for containments with larger amounts	$ containment
2.	Cove base and adhesives (multiple layers, including contaminated substrates), removal and disposal as ACM	$ lf

Item	Description	Unit Price
3.	Floor tile/flooring materials and mastics (includes all layers of carpeting, adhesives, multiple layers of floor tiles/flooring materials/linoleum/terrazzo and underlayment/sheet flooring/vinyl flooring/wood/mastics, levelastics, contaminated flooring materials, etc.), removal and disposal as ACM	$ sf
4.	Mudded pipe fitting insulation, removal and disposal as ACM	$ fitting/joint
5.	Glove bag, removal and disposal as ACM	$ bag
6.	Pipe and pipe fitting insulation, removal and disposal as ACM	$ lf
7.	Floor spacer material (including contaminated substrates), removal and disposal as ACM	$ lf
8.	Fire door/insulation, removal and disposal as ACM	$ door
9.	Transite cement board, removal and disposal as ACM	$ sf
10.	Wall adhesives including contaminated substrates (mirrors/blackboards/bulletin boards/wood/wall tiles, etc.), removal and disposal as ACM	$ sf
11.	Vermiculite and associated wall/ceiling materials (including contaminated substrates), removal and disposal as ACM	$ sf
12.	Wall/Ceiling plaster (multiple layers) and supporting systems and contaminated substrates, removal and disposal as ACM	$ sf
13.	Wall/Ceiling board/gypsum board/taping/joint compounds (multiple layers), removal and disposal as ACM	$ sf
14.	Dampproofing/tars/mastics – interior/exterior walls/floors/slab/foundations and associated substrate/adjacent materials (includes multiple layers, contaminated materials and substrates), removal and disposal as ACM	$ sf of walls
		$ sf of slabs
		$ sf of foundations
15.	Caulking, glazing and sealant compounds (includes substrate and contaminated materials), removal and disposal as ACM	$ lf
		$ window opening (multiple windows/sizes exist in openings)
		$ door opening (multiple doors/sizes exist in openings)
16.	Caulking, glazing and sealant compounds, removal and disposal as PCB >50ppm (PCB Bulk Product Waste)	$ lf
		$ window opening (multiple windows/sizes exist in openings)
		$ door opening (multiple doors/sizes exist in openings)
17.	Caulking, glazing and sealant compounds, removal and disposal as ACM and PCB >50ppm (PCB Bulk Product Waste)	$ lf
		$ window opening (multiple windows/sizes exist in openings)
		$ door opening (multiple doors/sizes exist in openings)

Item	Description	Unit Price
18.	Roofing core/field base material (includes multiple layers and substrates), removal and disposal as ACM	$ sf
19.	Roof flashing (includes multiple layers and substrates), removal and disposal as ACM	$ sf
20.	Add pressure treated wood blocking, as specified, cut to fit around systems installed	$ bf
21.	Deduct pressure treated wood blocking, as specified, cut to fit around systems installed	$ bf

If written notice of the acceptance of this Bid is mailed, telegraphed, or delivered to the undersigned at the Address designated below, within ninety (90) days after the date of Bid Opening, or any time thereafter before this Bid is withdrawn, the undersigned will, within ten (10) days after the date of mailing, telegraphing, or delivering of the notice, execute and deliver a contract in the Standard Form of Agreement Between the Owner and Contractor, AIA Document A101, or similar contract modified as may be mutually agree upon.

The undersigned acknowledges that he has examined the documents, visited and examined the site as required under "Instructions to Bidders", examined the availability of labor and materials and further agrees to comply with all the requirements as to the conditions of employment and wage rates set forth by the State of Connecticut Department of Labor.

Addenda:

The undersigned acknowledges receipt of the following addenda to the Contract Documents, listed by number and date:

Number , Dated: _____ Number , Dated: _____
Number , Dated: _____ Number , Dated: _____

Exceptions: _____

NON-COLLUSIVE BID STATEMENT

The undersigned bidder certifies that this bid is made independently and without collusion, agreement, understanding or planned course of action with any other bidder and that the contents of the bid shall not be disclosed to anyone other than employees, agents, or sureties prior to the official bid opening.

ATTACHMENTS – Attached hereto is:

1. **Bid Bond**
2. **Contractor Prequalification Statement**
3. **Update Bid Statement**
4. **Non-Collusive Bid Statement/Affidavit**
5. **Bidder Information**
6. **Insurance Procedures**

Signature: _____ Date: _____

Printed Name and Title
of Agent submitting bid: _____

Name of Company: _____

Address: _____

Telephone Number: _____ Fax Number: _____

E-mail: _____

This Bid may be withdrawn prior to the scheduled Bid Opening or any postponement thereof.

AIA® Document G702® – 1992

Application and Certificate for Payment

TO OWNER:	**PROJECT:** GENERIC	**APPLICATION NO:** 001	**Distribution to:**	
			OWNER : [ ]	
		PERIOD TO: January 1, 2026	ARCHITECT : [ ]	
		CONTRACT FOR:	CONTRACTOR : [ ]	
FROM	**VIA**	**CONTRACT DATE:** 01-06-2026	FIELD : [ ]	
CONTRACTOR:	**ARCHITECT:**	**PROJECT NOS:** / /	OTHER : [ ]	

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
AIA Document G703®, Continuation Sheet, is attached.

1. ORIGINALCONTRACT SUM.....		0.00
2. NET CHANGE BY CHANGE ORDERS.....		0.00
3. CONTRACT SUM TO DATE(Line 1 ± 2).....		0.00
4. TOTAL COMPLETED & STORED TO DATE(Column G on G703).....		0.00
5. RETAINAGE:		
a. 0.00% of Completed Work (Column D + E on G703: 0.00)=	0.00	
b. 0.00% of Stored Material (Column F on G703: 0.00)=	0.00	
Total Retainage (Lines 5a + 5b or Total in Column I of G703).....		0.00
6. TOTAL EARNED LESS RETAINAGE..... (Line 4 Less Line 5 Total)		0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT..... (Line 6 from prior Certificate)		0.00
8. CURRENT PAYMENT DUE.....		0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)		0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	0.00	0.00
Total approved this Month	0.00	0.00
TOTALS	0.00	0.00
NET CHANGES by Change Order		0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED..... 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

DRAFT

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AIA® Document G703® – 1992

Continuation Sheet

AIA Document G702®, Application and Certification for Payment, or G732™, Application and Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:	
APPLICATION DATE:	01-01-2026
PERIOD TO:	January 1, 2026
ARCHITECT'S PROJECT NO:	

A	B	C	D	E	F	G		H	I
			WORK COMPLETED						
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00%**	**0.00**	**0.00**

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CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION

CONTRACTORS WAGE CERTIFICATION FORM

Construction Manager at Risk/General Contractor/Prime Contractor

I,_____ of _____
Officer, Owner, Authorized Rep. Company Name

do hereby certify that the _____
Company Name

_____
Street

_____
City

and all of its subcontractors will pay all workers on the

_____
Project Name and Number

_____
Street and City

the wages as listed in the schedule of prevailing rates required for such project (a copy of which is attached hereto).

_____
Signed

Subscribed and sworn to before me this _____ day of _____,_____.

_____
Notary Public

Return to:

Connecticut Department of Labor
Wage & Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

Rate Schedule Issued (Date): _____

Minimum Rates and Classifications
for Building Construction

ID#: 26-12517

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: Greenwich
State#:
FAP#:
Project: Eastern Middle School: Secure Entrance

CLASSIFICATION	Hourly Rate	Benefits
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	50.16	35.30
2) Boilermaker	50.21	30.01
3a) Bricklayer, Cement Mason, Concrete Finisher (including caulking), Stone Masons	45.76	38.45 + a
3b) Tile Setter	43.0	34.75
3c) Tile and Stone Finishers	36.0	29.43
3d) Marble & Terrazzo Finishers	35.7	29.73
3e) Plasterer	44.52	29.63

As of: November 5, 2026

3f) Terrazzo Mechanics & Marble Setters	40.6	39.93
------LABORERS------		
4) Group 1: General laborers, carpenter tenders, concrete specialists, wrecking laborers and fire watchers.	37.0	30.47
4) Group 1a: Acetylene Burners (Hours worked with a torch)	38.0	30.47
4a) Group 2: Mortar mixers, plaster tender, power buggy operators, powdermen, fireproofer/mixer/nozzleman (Person running mixer and spraying fireproof only).	37.25	30.47
4b) Group 3: Jackhammer operators/pavement breaker, mason tender (brick), mason tender (cement/concrete), forklift operators and forklift operators (masonry).	37.5	30.47
4c) **Group 4: Pipelayers: Licensed P6 -P7 (one or two employees of the total crew who primary task is to perform mating of pipe sections).	38.0	30.47
4d) Group 5: Air track operator, sand blaster and hydraulic drills.	37.75	30.47
4e) Group 6: Blasters, nuclear and toxic waste removal.	40.0	30.47
4f) Group 7: Asbestos/lead removal and encapsulation (except it's removal from mechanical systems which are not to be scrapped).	40.0	30.47
4g) Group 8: Bottom men on open air caisson, cylindrical work and boring crew.	37.5	30.47
4h) Group 9: Top men on open air caisson, cylindrical work and boring crew.	37.0	30.47

4i) Group 10: Traffic Control Signalman	22.2	30.47
4j) Group 11: Toxic Waste Removers A or B With PPE	40.0	30.47
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.	44.48	29.74
5a) Millwrights	45.14	30.24
5b) Carpenter - Welder	44.98	29.74
5c) Carpenter: Working with creosote lumber or acid	45.48	29.74
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)	58.75	39.629
7a) Elevator Mechanic (Trade License required: R-1,2,5,6)	69.55	38.985+a+b
-----OUTSIDE LINE CONSTRUCTION----		
Groundman	33.41	14.50
Linemen/Cable Splicer	60.74	35.03
Teledata Wiremen | Teledata Wireman	40.19	10.46

As of: November 5, 2026

8) Glazier (Trade License required: FG-1,2)	44.73	27.65+ a
9) Ironworker, Ornamental, Reinforcing, Structural, and Precast Concrete Erection	45.25	46.62 + a
----OPERATORS----		
Group 1: Crane Handling or Erecting Structural Steel or Stone, Hoisting Engineer (2 drums or over), Deep Shaft over 14". (Trade License Required)	60.66	30.95 + a
Group 1a: Front End Loader (7 cubic yards or over); Work Boat 26 ft. and Over	55.6	30.95 + a
Group 2: Cranes (100 ton rate capacity and over). (Trade License Required)	60.24	30.95 + a
Group 2a: Cranes (under 100 ton rated capacity), Magni Type-360 Rotating Forklift.	59.2	30.95 + a
Group 2b: Excavator over 2 cubic yards; Pile Driver ($3.00 premium when operator controls hammer), HF-1 Forklift, Drills with self contained power units, Micropile up to 14 inches helical pile.	55.17	30.95 + a
Group 3: Excavator; Gradall; 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 Finegrade. (slopes, shaping, laser or GPS, etc.). (Trade License Required)	54.13	30.95 + a
Group 4: Trenching Machines; Lighter Derrick; CMI Machine or Similar; Koehring Loader (Skooper); Goldhofer.	53.61	30.95 + a
Group 5: Specialty Railroad Equipment; Asphalt Spreader, 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 mandrel).	52.78	30.95 + a

Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller, Geothermal Drill.	52.78	30.95 + a
Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).	52.35	30.95 + 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 mandrel).	51.89	30.95 + a
Group 8: Mechanic; Grease Truck Operator; Hydroblaster; Barrier Mover; Power Stone Spreader; Welding; Work Boat Under 26 ft.; Transfer Machine; Rigger Foreman.	51.34	30.95 + 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); Vacuum Excavation Truck and Hydrovac Excavation Truck (27 HG pressure or greater).	50.74	30.95 + a
Group 10: Vibratory hammer; ice machine; diesel and air, hammer, etc.	47.91	30.95 + a
Group 11: Conveyor, earth roller, power pavement breaker (whiphammer), robot demolition equipment.	47.91	30.95 + a
Group 12: Wellpoint Operator.	47.82	30.95 + a
Group 13: Compressor Battery Operator.	47.04	30.95 + a
Group 14: Elevator Operator; Tow Motor Operator (solid tire no rough terrain).	45.45	30.95 + a
Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.	44.89	30.95 + a

Group 16: Maintenance Engineer and Articulating End Dump.	43.99	30.95 + a
Group 17: Portable Asphalt Plant Operator; Portable Crusher Plant Operator; Portable Concrete Plant Operator; Portable Grout Plant Operator; Portable Water Filtration Plant Operator.	49.95	30.95 + a
Group 18: Power Safety Boat; Vacuum Truck; Zim Mixer; Sweeper; (Minimum for any job requiring a CDL license); Rigger; Signalman.	46.6	30.95 + a
Surveyor: Chief of Party	50.21	30.95 + a
Surveyor: Assistant Chief of Party	46.3	30.95 + a
Surveyor: Instrument Man	44.55	30.95 + a
Surveyor: Rodman or Chainman	38.34	30.95 + a
------PAINTERS (Including Drywall Finishing)------		
10a) Brush and Roller	41.17	27.65
10b) Taping Only/Drywall Finishing	41.92	27.65
10c) Paperhanger and Red Label	41.67	27.65
10d) Spray	44.17	27.65
10e) Spray Helper	42.17	27.65

10f) Blast	46.17	27.65
10g) Blast Helper	42.17	27.65
11) Plumber (excluding HVAC pipe installation) (Trade License required: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2)	52.08	36.80
12) Well Digger, Pile Testing Machine	37.26	24.05 + a
Roofer: Cole Tar Pitch	47.5	26.24 + a
Roofer: Slate, Tile, Composition, Shingles, Singly Ply and Damp/Waterproofing	46.0	26.24 + a
15) Sheetmetal Worker (Trade License required for HVAC and Ductwork: SM-1,SM-2,SM-3,SM-4,SM-5,SM-6)	57.29	48.70
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)	52.08	36.80
------TRUCK DRIVERS------		
17) Block Truck	39.98	33.00 + a
17a) 2 Axle	38.66	33.00 + a
17ab) Helpers	36.16	33.00 + a

17b) 3 Axle, 2 Axle Mixer	38.77	33.00 + a
17c) 3 Axle Mixer	38.83	33.00 + a
17d) 4 Axle	38.89	33.00 + a
17e) 4 Axle Mixer	40.69	33.00 + a
17ef) 5 Axle	38.89	33.00 + a
17eg) 5 Axle Mixer	40.69	33.00 + a
17f) Heavy Duty Trailer (40 Tons and Over)	41.16	33.00 + a
17g) Euclids and Semi-Trailer	38.94	33.00 + a
17h) Heavy Duty Trailer up to 40 tons	39.89	33.00 + a
17i) Snorkle Truck	39.04	33.00 + a
17j) Swivel Dump and Tack Truck	38.89	33.00 + a
18) Sprinkler Fitter (Trade License required: F-1,2,3,4)	56.78	35.24 + a
19) Theatrical Stage Journeyman	25.76	7.34

Welders: Rate for craft to which welding is incidental.

Surveyors: Hazardous material removal: $3.00 per hour premium.

*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.

Truck Drivers: Trainers Premium: $3.00 over wage rate.

Truck Drivers: Night Premium - Mixer Drivers: $2.00 over wage rate.

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.

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.

As of: November 5, 2026

~~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: November 5, 2026

Connecticut Department of Labor
Wage and Workplace Standards Division
FOOTNOTES

⇨ Please Note: If the "Benefits" listed on the schedule for the following occupations includes a letter(s) (+ a or + a+b for instance), refer to the information below.

Benefits to be paid at the appropriate prevailing wage rate for the listed occupation.

If the "Benefits" section for the occupation lists only a dollar amount, disregard the information below.

Bricklayers, Cement Masons, Cement Finishers, Concrete Finishers, Stone Masons
(Building Construction) and
(Residential- Hartford, Middlesex, New Haven, New London and Tolland Counties)

a. Paid Holiday: Employees shall receive 4 hours for Christmas Eve holiday provided the employee works the regularly scheduled day before and after the holiday. Employers may schedule work on Christmas Eve and employees shall receive pay for actual hours worked in addition to holiday pay.

Dredging (Heavy)

a. Paid Holidays: New Year's Day, Martin Luther King, Jr.'s Birthday, Memorial Day, Good Friday, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

b. Vacation: Eight Percent (8%) of the straight time rate, multiplied by the total hours worked.

Elevator Constructors: Mechanics

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day, plus the Friday after Thanksgiving.

b. Vacation: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.

Glaziers

a. Paid Holidays: Labor Day and Christmas Day.

Power Equipment Operators
(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Good Friday, Memorial day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, provided the employee works 3 days during the week in which the holiday falls, if scheduled, and if scheduled, the working day before and the working day after the holiday. Holidays falling on Saturday may be observed on Saturday, or if the employer so elects, on the preceding Friday.

Ironworkers

a. Paid Holiday: Labor Day provided employee has been on the payroll for the 5 consecutive work days prior to Labor Day.

Laborers (Tunnel Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. No employee shall be eligible for holiday pay when he fails, without cause, to work the regular work day preceding the holiday or the regular work day following the holiday.

Roofers

a. Paid Holidays: July 4th, Labor Day, and Christmas Day provided the employee is employed 15 days prior to the holiday.

Sprinkler Fitters

a. Paid Holidays: Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day, provided the employee has been in the employment of a contractor 20 working days prior to any such paid holiday.

Truck Drivers
(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas day, and Good Friday, provided the employee has at least 31 calendar days of service and works the last scheduled day before and the first scheduled day after the holiday, unless excused.

STATUTE 31-55a

- SPECIAL NOTICE –

To All State and Political Subdivisions,Their Agents, and Contractors
Connecticut General Statute 31-55a - Annual adjustments to wage rates by contractors doing state work.

Each contractor that is awarded a contract on or after October 1, 2002, for (1) the construction of a state highway or bridge that falls under the provisions of section 31-54 of the general statutes, or (2) the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project that falls under the provisions of section 31-53 of the general statutes shall contact the Labor Commissioner on or before July first of each year, for the duration of such contract, to ascertain the prevailing rate of wages on an hourly basis and the amount of payment or contributions paid or payable on behalf of each mechanic, laborer or worker employed upon the work contracted to be done, and shall make any necessary adjustments to such prevailing rate of wages and such payment or contributions paid or payable on behalf of each such employee, effective each July first.

- The prevailing wage rates applicable to any contract or subcontract awarded on or after October 1, 2002 are subject to annual adjustments each July 1st for the duration of any project which was originally advertised for bids on or after October 1, 2002.
- Each contractor affected by the above requirement 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 Web Site. The annual adjustments will be posted on the Department of Labor Web page: www.ctdol.state.ct.us. 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.

Any questions should be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at (860)263-6790.

Information Bulletin
Occupational Classifications

The Connecticut Department of Labor has the responsibility to properly determine *"job classification"* on prevailing wage projects covered under C.G.S. Section 31-53(d).

Note: This information is intended to provide a sample of some occupational classifications for guidance purposes only. It is not an all-inclusive list of each occupation's duties. This list is being provided only to highlight some areas where a contractor may be unclear regarding the proper classification. If unsure, the employer should seek guidelines for CTDOL.

Below are additional clarifications of specific job duties performed for certain classifications:

- ***ASBESTOS WORKERS***

Applies all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems.

- ***ASBESTOS INSULATOR***

Handle, install apply, fabricate, distribute, prepare, alter, repair, dismantle, heat and frost insulation, including penetration and fire stopping work on all penetration fire stop systems.

- ***BOILERMAKERS***

Erects hydro plants, incomplete vessels, steel stacks, storage tanks for water, fuel, etc. Builds incomplete boilers, repairs heat exchanges and steam generators.

- ***BRICKLAYERS, CEMENT MASONS, CEMENT FINISHERS, MARBLE MASONS, PLASTERERS, STONE MASONS, PLASTERERS. STONE MASONS, TERRAZZO WORKERS, TILE SETTERS***

Lays building materials such as brick, structural tile and concrete cinder, glass, gypsum, terra cotta block. Cuts, tools and sets marble, sets stone, finishes concrete, applies decorative steel, aluminum and plastic tile, applies cements, sand, pigment and marble chips to floors, stairways, etc.

- ***<u>CARPENTERS, MILLWRIGHTS. PILEDRIVERMEN. LATHERS. RESILEINT FLOOR LAYERS, DOCK BUILDERS, DIKERS, DIVER TENDERS</u>***

Constructs, erects, installs and repairs structures and fixtures of wood, plywood and wallboard. Installs, assembles, dismantles, moves industrial machinery. Drives piling into ground to provide foundations for structures such as buildings and bridges, retaining walls for earth embankments, such as cofferdams. Fastens wooden, metal or rockboard lath to walls, ceilings and partitions of buildings, acoustical tile layer, concrete form builder. Applies firestopping materials on fire resistive joint systems only. Installation of curtain/window walls only where attached to wood or metal studs. Installation of insulated material of all types whether blown, nailed or attached in other ways to walls, ceilings and floors of buildings. Assembly and installation of modular furniture/furniture systems. Free-standing furniture is not covered. This includes free standing: student chairs, study top desks, book box desks, computer furniture, dictionary stand, atlas stand, wood shelving, two-position information access station, file cabinets, storage cabinets, tables, etc.

- **LABORER, CLEANING**

• The clean up of any construction debris and the general (heavy/light) cleaning, including sweeping, wash down, mopping, wiping of the construction facility and its furniture, washing, polishing, and dusting.

- **DELIVERY PERSONNEL**

• If delivery of supplies/building materials is to one common point and stockpiled there, prevailing wages <u>are not required</u>. If the delivery personnel are involved in the distribution of the material to multiple locations within the construction site then they would have to be paid prevailing wages for the type of work performed: laborer, equipment operator, electrician, ironworker, plumber, etc.

• An example of this would be where delivery of drywall is made to a building and the delivery personnel distribute the drywall from one "stockpile" location to further sub-locations on each floor. Distribution of material around a construction site is the job of a laborer or tradesman, and not a delivery personnel.

- ***<u>ELECTRICIANS</u>***

Install, erect, maintenance, alteration or repair of any wire, cable, conduit, etc., which generates, transforms, transmits or uses electrical energy for light, heat, power or other purposes, including the Installation or maintenance of telecommunication, LAN wiring or computer equipment, and low voltage wiring. ****License required per Connecticut General Statutes: E-1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9.***

- ***ELEVATOR CONSTRUCTORS***

Install, erect, maintenance and repair of all types of elevators, escalators, dumb waiters and moving walks. ****License required by Connecticut General Statutes: R-1,2,5,6.***

- ***FORK LIFT OPERATOR***

Laborers Group 4) Mason Tenders - operates forklift solely to assist a mason to a maximum height of nine (9) feet only.

Power Equipment Operator Group 9 - operates forklift to assist any trade, and to assist a mason to a height over nine (9) feet.

- ***GLAZIERS***

Glazing wood and metal sash, doors, partitions, and 2 story aluminum storefronts. Installs glass windows, skylights, store fronts and display cases or surfaces such as building fronts, interior walls, ceilings and table tops and metal store fronts. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers, which require equal composite workforce.

- ***IRONWORKERS***

Erection, installation and placement of structural steel, precast concrete, miscellaneous iron, ornamental iron, metal curtain wall, rigging and reinforcing steel. Handling, sorting, and installation of reinforcing steel (rebar). Metal bridge rail (traffic), metal bridge handrail, and decorative security fence installation. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers which require equal composite workforce.

- ***INSULATOR***

• Installing fire stopping systems/materials for "Penetration Firestop Systems": transit to cables, electrical conduits, insulated pipes, sprinkler pipe penetrations, ductwork behind radiation, electrical cable trays, fire rated pipe penetrations, natural polypropylene, HVAC ducts, plumbing bare metal, telephone and communication wires, and boiler room ceilings.

- ***LABORERS***

Acetylene burners, asphalt rakers, chain saw operators, concrete and power buggy operator, concrete saw operator, fence and guard rail erector (except metal bridge rail (traffic), decorative security fence (non-metal).

installation.), hand operated concrete vibrator operator, mason tenders, pipelayers (installation of storm drainage or sewage lines on the street only), pneumatic drill operator, pneumatic gas and electric drill operator, powermen and wagon drill operator, air track operator, block paver, curb setters, blasters, concrete spreaders.

- ***PAINTERS***

Maintenance, preparation, cleaning, blasting (water and sand, etc.), painting or application of any protective coatings of every description on all bridges and appurtenances of highways, roadways, and railroads. Painting, decorating, hardwood finishing, paper hanging, sign writing, scenic art work and drywall hhg for any and all types of building and residential work.

- ***LEAD PAINT REMOVAL***

• Painter's Rate

1. Removal of lead paint from bridges.
2. Removal of lead paint as preparation of any surface to be repainted.
3. Where removal is on a Demolition project prior to reconstruction.

• Laborer's Rate

1. Removal of lead paint from any surface NOT to be repainted.
2. Where removal is on a *TOTAL* Demolition project only.

- ***PLUMBERS AND PIPEFITTERS***

Installation, repair, replacement, alteration or maintenance of all plumbing, heating, cooling and piping. ****License required per Connecticut General Statutes: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2 S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4.***

- ***POWER EQUIPMENT OPERATORS***

Operates several types of power construction equipment such as compressors, pumps, hoists, derricks, cranes, shovels, tractors, scrapers or motor graders, etc. Repairs and maintains equipment. ****License required, crane operators only, per Connecticut General Statutes.***

- ***ROOFERS***

Covers roofs with composition shingles or sheets, wood shingles, slate or asphalt and gravel to waterproof roofs, including preparation of surface. (demolition or removal of any type of roofing and or clean-up of any and all areas where a roof is to be relaid.)

- ***SHEETMETAL WORKERS***

Fabricate, assembles, installs and repairs sheetmetal products and equipment in such areas as ventilation, air-conditioning, warm air heating, restaurant equipment, architectural sheet metal work, sheetmetal roofing, and aluminum gutters. Fabrication, handling, assembling, erecting, altering, repairing, etc. of coated metal material panels and composite metal material panels when used on building exteriors and interiors as soffits, facia, louvers, partitions, canopies, cornice, column covers, awnings, beam covers, cladding, sun shades, lighting troughs, spires, ornamental roofing, metal ceilings, mansards, copings, ornamental and ventilation hoods, vertical and horizontal siding panels, trim, etc. The sheet metal classification also applies to the vast variety of coated metal material panels and composite metal material panels that have evolved over the years as an alternative to conventional ferrous and non-ferrous metals like steel, iron, tin, copper, brass, bronze, aluminum, etc. Fabrication, handling, assembling, erecting, altering, repairing, etc. of architectural metal roof, standing seam roof, composite metal roof, metal and composite bathroom/toilet partitions, aluminum gutters, metal and composite lockers and shelving, kitchen equipment, and walk-in coolers. To include testing and air –balancing ancillary to installation and construction.

- ***SPRINKLER FITTERS***

Installation, alteration, maintenance and repair of fire protection sprinkler systems. ****License required per Connecticut General Statutes: F-1,2,3,4.***

- ***TILE MARBLE AND TERRAZZO FINISHERS***

Assists and tends the tile setter, marble mason and terrazzo worker in the performance of their duties.

- **TRUCK DRIVERS**

~How to pay truck drivers delivering asphalt is under REVISION~

Truck Drivers are requires to be paid prevailing wage for time spent "working" directly on the site. These drivers remain covered by the prevailing wage for any time spent transporting between the actual construction location and facilities (such as fabrication, plants, mobile factories, batch plant, borrow pits, job headquarters, tool yards, etc.) dedicated exclusively, or nearly so, to performance of the contract or project, which are so located in proximity to the actual construction location that it is reasonable to include them. ****License required, drivers only, per Connecticut General Statutes.***

For example:

• Material men and deliverymen are not covered under prevailing wage as long as they are not directly involved in the construction process. If, they unload the material, they would then be covered by prevailing wage for the classification they are performing work in: laborer, equipment operator, etc.
• Hauling material off site is not covered provided they are not dumping it at a location outlined above.
• Driving a truck on site and moving equipment or materials on site would be considered covered work, as this is part of the construction process.

➢ *Any questions regarding the proper classification should be directed to:*
Public Contract Compliance Unit
Wage and Workplace Standards Division
Connecticut Department of Labor
200 Folly Brook Blvd, Wethersfield, CT 06109
(860) 263-6543.

Sec. 31-53b. Worker training requirements for public works projects. Enforcement. Regulations. Exceptions. (a) Each contract for a public works project entered into on or after July 1, 2009, by the state or any of its agents, or by any political subdivision of the state or any of its agents, described in subsection (h) of section 31-53, shall contain a provision requiring that each contractor furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 46 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268, and on or after July 1, 2012, that any plumber or electrician subject to the continuing education requirements of section 20-334d, who has completed a course of at least ten hours in duration in construction safety and health approved by federal Occupational Safety and Health Administration five or more years prior to the date such electrician or plumber begins work on such public works project, has completed a supplemental refresher training course of at least four hours in duration in construction safety and health taught by a federal Occupational Safety and Health Administration authorized trainer.

(b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance. The Labor Commissioner or said commissioner's designee shall enforce this section.

(c) Not later than January 1, 2012, the Labor Commissioner shall adopt regulations, in accordance with the provisions of chapter 54, to implement the provisions of subsections (a) and (b) of this section. Such regulations shall require that the ten-hour construction safety and health courses required under subsection (a) of this section be conducted in accordance with federal Occupational Safety and Health Administration Training Institute standards, or in the case of a supplemental refresher training course, shall include, but not be limited to, an update of revised Occupational Safety and Health Administration standards and a review of required construction hazards training, or in accordance with Federal Mine Safety and Health Administration Standards or in accordance with 29 CFR 1910.268, as appropriate. The Labor Commissioner shall accept as sufficient proof of compliance with the provisions of subsection (a) or (b) of this section a student course completion card issued by the federal Occupational Safety and Health Administration Training Institute, or such other proof of compliance said commissioner deems appropriate, dated no earlier than five years before the commencement date of such public works project or, in the case of supplemental refresher training, a student course completion card issued by said Occupational Safety and Health Administration authorized

trainer dated not earlier than five years prior to the date such electrician or plumber begins work on such public works project.

(d) This section shall not apply to employees of public service companies, as defined in section 16-1, or drivers of commercial motor vehicles driving the vehicle on the public works project and delivering or picking up cargo from public works projects provided they perform no labor relating to the project other than the loading and unloading of their cargo.

(P.A. 06-175, S. 1; P.A. 08-83, S. 1; P.A. 10-47, S. 2; P.A. 11-63, S. 1)

History: P.A. 08-83 amended Subsec. (a) by making provisions applicable to public works project contracts entered into on or after July 1, 2009, replacing provision re total cost of work with reference to Sec. 31-53(g), requiring proof in certified payroll form that new mechanic, laborer or worker has completed a 10-hour or more construction safety course and adding provision re new miner training program, amended Subsec. (b) by substituting "person" for "employee" and adding "or program", amended Subsec. (c) by adding "or in accordance with Federal Mine Safety and Health Administration Standards" and setting new deadline of January 1, 2009, deleted former Subsec. (d) re "public building", added new Subsec. (d) re exemptions for public service company employees and delivery drivers who perform no labor other than delivery and made conforming and technical changes, effective January 1, 2009; P.A. 10-47 made a technical change in Subsec. (a); P.A. 11-63 amended Subsec. (a) by adding provision re supplemental refresher training course for plumbers and electricians subject to Sec. 20-334d, amended Subsec. (c) by adding provisions re regulations and subject matter of refresher training course and refresher train course student completion cards, and made technical changes, effective July 1, 2011.



Opportunity ⋆ Guidance ⋆ Support

CONNECTICUT
DEPARTMENT
OF LABOR

THIS IS A PUBLIC WORKS PROJECT

Covered by the

PREVAILING WAGE LAW

CT General Statutes Section 31-53

If you have QUESTIONS regarding your wages
CALL (860) 263-6790

Section 31-55 of the CT State Statutes requires every contractor or subcontractor performing work for the state to post in a prominent place the prevailing wages as determined by the Labor Commissioner.

Informational Bulletin

THE 10-HOUR OSHA CONSTRUCTION SAFETY AND HEALTH COURSE

(applicable to public building contracts entered into *on or after July 1, 2007*, where the total cost of all work to be performed is at least $100,000)

(1) This requirement was created by Public Act No. 06-175, which is codified in Section 31-53b of the Connecticut General Statutes (pertaining to the prevailing wage statutes);

(2) The course is required for public building construction contracts (projects funded in whole or in part by the state or any political subdivision of the state) entered into on or after July 1, 2007;

(3) It is required of private employees (not state or municipal employees) and apprentices who perform manual labor for a general contractor or subcontractor on a public building project where the total cost of all work to be performed is at least $100,000;

(4) The ten-hour construction course pertains to the ten-hour Outreach Course conducted in accordance with federal OSHA Training Institute standards, and, for telecommunications workers, a ten-hour training course conducted in accordance with federal OSHA standard, 29 CFR 1910.268;

(5) The internet website for the federal OSHA Training Institute is http://www.osha.gov/fso/ote/training/edcenters/fact_sheet.html;

(6) The statutory language leaves it to the contractor and its employees to determine who pays for the cost of the ten-hour Outreach Course;

(7) Within 30 days of receiving a contract award, a general contractor must furnish proof to the Labor Commissioner that all employees and apprentices performing manual labor on the project will have completed such a course;

(8) Proof of completion may be demonstrated through either: (a) the presentation of a *bona fide* student course completion card issued by the federal OSHA Training Institute; *or* (2) the presentation of documentation provided to an employee by a trainer certified by the Institute pending the actual issuance of the completion card;

(9) Any card with an issuance date more than 5 years prior to the commencement date of the construction project shall not constitute proof of compliance;

(10) Each employer shall affix a copy of the construction safety course completion card to the certified payroll submitted to the contracting agency in accordance with Conn. Gen. Stat. § 31-53(f) on which such employee's name first appears;

(11) Any employee found to be in non-compliance shall be subject to removal from the worksite if such employee does not provide satisfactory proof of course completion to the Labor Commissioner by the fifteenth day after the date the employee is determined to be in noncompliance;

(12) Any such employee who is determined to be in noncompliance may continue to work on a public building construction project for a maximum of fourteen consecutive calendar days while bringing his or her status into compliance;

(13) The Labor Commissioner may make complaint to the prosecuting authorities regarding any employer or agent of the employer, or officer or agent of the corporation who files a false certified payroll with respect to the status of an employee who is performing manual labor on a public building construction project;

(14) The statute provides the minimum standards required for the completion of a safety course by manual laborers on public construction contracts; any contractor can exceed these minimum requirements; and

(15) Regulations clarifying the statute are currently in the regulatory process, and shall be posted on the CTDOL website as soon as they are adopted in final form.

(16) Any questions regarding this statute may be directed to the Wage and Workplace Standards Division of the Connecticut Labor Department via the internet website of http://www.ctdol.state.ct.us/wgwkstnd/wgemenu.htm; or by telephone at (860)263-6790.

THE ABOVE INFORMATION IS PROVIDED EXCLUSIVELY AS AN EDUCATIONAL RESOURCE, AND IS NOT INTENDED AS A SUBSTITUTE FOR LEGAL INTERPRETATIONS WHICH MAY ULTMATELY ARISE CONCERNIG THE CONSTRUCTION OF THE STATUTE OR THE REGULATIONS.

November 29, 2006

Notice

To All Mason Contractors and Interested Parties Regarding Construction Pursuant to Section 31-53 of the Connecticut General Statutes (Prevailing Wage)

The Connecticut Labor Department Wage and Workplace Standards Division is empowered to enforce the prevailing wage rates on projects covered by the above referenced statute.

Over the past few years the Division has withheld enforcement of the rate in effect for workers who operate a forklift on a prevailing wage rate project due to a potential jurisdictional dispute.

The rate listed in the schedules and in our Occupational Bulletin (see enclosed) has been as follows:

Forklift Operator:

- **Laborers (Group 4) Mason Tenders** - operates forklift solely to assist a mason to a maximum height of nine feet only.

- **Power Equipment Operator (Group 9)** - operates forklift to assist any trade and to assist a mason to a height over nine feet.

The U.S. Labor Department conducted a survey of rates in Connecticut but it has not been published and the rate in effect remains as outlined in the above Occupational Bulletin.

Since this is a classification matter and not one of jurisdiction, effective January 1, 2007 the Connecticut Labor Department will enforce the rate on each schedule in accordance with our statutory authority.

Your cooperation in filing appropriate and accurate certified payrolls is appreciated.

NOTICE

TO ALL CONTRACTING AGENCIES

Please be advised that Connecticut General Statutes Section 31-53, requires the contracting agency to certify to the Department of Labor, the total dollar amount of work to be done in connection with such public works project, regardless of whether such project consists of one or more contracts.

Please find the attached “Contracting Agency Certification Form” to be completed and returned to the Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit.

Inquiries can be directed to 860.263.6790.







CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION

Contracting Agency Certification Form

I,_____, acting in my official capacity as _____,
Authorized Representative Title

for _____, located at _____,
Contracting Agency Address

do hereby certify that the total dollar amount of work to be done in connection with

_____, located at _____,
Project name and number Address

shall be $_____, which includes all work, regardless of whether such project contains of one or more contracts.

Contractor Information

Name: _____

Address: _____

Authorized Representative: _____

Approximate Starting Date: _____

Approximate Completion Date: _____

_____ _____
Signature Date

Return to:

Connecticut Department of Labor
Wage & Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

Rate Schedule Issued (Date): _____

[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

In accordance with Connecticut General Statutes, 31-53 Certified Payrolls with a statement of compliance shall be submitted monthly to the contracting agency.

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

WEEKLY PAYROLL

Connecticut Department of Labor
Wage and Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

CONTRACTOR NAME AND ADDRESS:

SUBCONTRACTOR NAME & ADDRESS

WORKER'S COMPENSATION INSURANCE CARRIER

POLICY #

EFFECTIVE DATE:
EXPIRATION DATE:

PAYROLL NUMBER | Week-Ending Date | PROJECT NAME & ADDRESS

PERSON/WORKER, ADDRESS and SECTION	APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION Trade License Type & Number - OSHA 10 Certification Number	DAY AND DATE S	M	T	W	TH	F	S HOURS WORKED EACH DAY	Total ST Hours Total O/T Hours	BASE HOURLY RATE TOTAL FRINGE BENEFIT PLAN CASH	TYPE OF FRINGE BENEFITS Per Hour 1 through 6 (see back)	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS FICA	FEDERAL WITH-HOLDING	STATE WITH-HOLDING	LIST OTHER	GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY
												$ Base Rate	1. $ 2. $ 3. $								
												$ Cash Fringe	4. $ 5. $ 6. $								
												$ Base Rate	1. $ 2. $ 3. $								
												$ Cash Fringe	4. $ 5. $ 6. $								
												$ Base Rate	1. $ 2. $ 3. $								
												$ Cash Fringe	4. $ 5. $ 6. $								
												$ Base Rate	1. $ 2. $ 3. $								
												$ Cash Fringe	4. $ 5. $ 6. $								

12/9/2013
WWS-CP1

*IF REQUIRED

*SEE REVERSE SIDE

PAGE NUMBER _____OF

OSHA 10 ~ATTACH CARD TO 1ST CERTIFIED PAYROLL

***FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

1) Medical or hospital care _____ 4) Disability_____

2) Pension or retirement _____ 5) Vacation, holiday_____

3) Life Insurance _____ 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of _____,

I, _____of _____, (hereafter known as

Employer) in my capacity as _____ (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

a) The records submitted are true and accurate;

b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;

c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);

d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;

e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and

f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

_____	_____	_____
(Signature)	(Title)	Submitted on (Date)

Section B: Applies to CONNDOT Projects ONLY

That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing wage requirements defined in Connecticut General Statutes Section 31-53.

_____	_____	_____
(Signature)	(Title)	Submitted on (Date)

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CP1 as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

*****THIS IS A PUBLIC DOCUMENT*****

*****DO NOT INCLUDE SOCIAL SECURITY NUMBERS*****

Weekly Payroll Certification For Public Works Projects (Continued)

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

Week-Ending Date:
Contractor or Subcontractor Business Name:

WEEKLY PAYROLL

PERSON/WORKER, ADDRESS and SECTION	APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION Trade License Type & Number - OSHA 10 Certification Number	DAY AND DATE S / M / T / W / TH / F / S HOURS WORKED EACH DAY	Total ST Hours Total O/T Hours	BASE HOURLY RATE TOTAL FRINGE BENEFIT PLAN CASH	TYPE OF FRINGE BENEFITS Per Hour 1 through 6 (see back)	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS FICA / FEDERAL WITH-HOLDING / STATE WITH-HOLDING / LIST OTHER	GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY
						$ Base Rate	1. $ 2. $ 3. $				
						$ Cash Fringe	4. $ 5. $ 6. $				
						$ Base Rate	1. $ 2. $ 3. $				
						$ Cash Fringe	4. $ 5. $ 6. $				
						$ Base Rate	1. $ 2. $ 3. $				
						$ Cash Fringe	4. $ 5. $ 6. $				
						$ Base Rate	1. $ 2. $ 3. $				
						$ Cash Fringe	4. $ 5. $ 6. $				
						$ Base Rate	1. $ 2. $ 3. $				
						$ Cash Fringe	4. $ 5. $ 6. $				

*IF REQUIRED

NOTICE: THIS PAGE MUST BE ACCOMPANIED BY A COVER PAGE (FORM # WWS-CP1)

Rev. 9/25/2025 v4 Approved by Board: 9/25/2025

2026-27 Greenwich Public Schools District Calendar

AUGUST

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Month:		
2	days / students	
6	days / teachers	
Cumulative:		
2	days / students	
6	days / teachers	

TBD Summer School Ends
24 First Day for All Teachers
25 Professional Learning Day (PLD)
26 Professional Learning Day (PLD)
27 Grade 6&9 Orientation (Early Release)
28 First Day for All Students

SEPTEMBER

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Month:		
20	days / students	
20	days / teachers	
Cumulative:		
22	days / students	
26	days / teachers	

7 Labor Day-Schools Closed
11 Rosh Hashanah at Sundown - Schools Open
21 Yom Kippur - Schools Closed

OCTOBER

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Month:		
22	days / students	
22	days / teachers	
Cumulative:		
44	days / students	
48	days / teachers	

12 Columbus Day - Schools Open
20 Teacher Collab - Early Release

NOVEMBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Month:		
18	days / students	
18	days / teachers	
Cumulative:		
62	days / students	
66	days / teachers	

3 Election Day - Schools Closed
8 Diwali (Sunday)
11 Veterans Day - Schools Open
25 Early Release
26, 27 Thanksgiving Recess - Schools Closed

DECEMBER

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Month:		
15	days / students	
16	days / teachers	
Cumulative:		
77	days / students	
82	days / teachers	

7 Teacher PLD - Schools Closed - K-8 Conf.
8 K-8 Conf. - K- 8 Early Release
10 Elementary Conferences Evening
22 Early Release
23 - 31 Holiday Recess - Schools Closed

JANUARY

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Month:		
19	days / students	
19	days / teachers	
Cumulative:		
96	days / students	
101	days / teachers	

1 New Years Day - Schools Closed
4 School Resumes
18 Dr. MLK, Jr. Day - Schools Closed
26 Teacher Collab - Early Release

FEBRUARY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

Month:		
14	days / students	
14	days / teachers	
Cumulative:		
110	days / students	
115	days / teachers	

6 Lunar New Year (Saturday)
8-12 Winter Recess - Schools Closed
15 President's Day - Schools Closed

MARCH

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Month:		
22	days / students	
22	days / teachers	
Cumulative:		
132	days / students	
137	days / teachers	

8 K-5 Conf. - K- 5 Early Release
10 Eid al-Fitr - Schools Open
17 K-5 Early Release, K-5 Conferences
23 Teacher Collab - Early Release
26 Good Friday - Closed

APRIL

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Month:		
17	days / students	
17	days / teachers	
Cumulative:		
149	days / students	
154	days / teachers	

12-16 Spring Recess - Schools Closed

MAY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Month:		
20	days / students	
20	days / teachers	
Cumulative:		
169	days / students	
174	days / teachers	

17 Eid al-Adha - Schools Open
28 Early Release
31 Memorial Day-Schools Closed

Note: There shall be no athletic games or activity competitions, projects, homework or major assignments the everning before or on recognized and religious hoildays, and no instructional assignments required to be worked on during Thankgiving, Holiday, Winter and Spring recesses.

JUNE

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Month:		
11	days / students	
13	days / teachers	
Cumulative:		
180	days / students	
187	days / teachers	

GHS Graduation: TBD
21 Last Day for Grade 6&9 (Includes 5 Snow Days)**
22 Last Day for Students (Includes 5 Snow Days)** Early Release
24 Last Day for Staff (Includes 5 Snow Days)**

JULY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Summer School Dates: TBD
** If more snow / storm days are needed, they will be taken from either the remaining days in June or from the Spring Recess in April. Please plan accordingly.

180 Days / Students, 187 Days / Teachers

Rev. 09/25 FINAL

2027-28 Greenwich Public Schools District Calendar

AUGUST

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Month:	
3	days / students
7	days / teachers
Cumulative:	
3	days / students
7	days / teachers

TBD Summer School Ends
23 First Day for All Teachers
24 Professional Learning Day (PLD)
25 Professional Learning Day (PLD)
26 Early Release - Grade 6&9 Orientation
27 First Day for All Students

SEPTEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Month:	
21	days / students
21	days / teachers
Cumulative:	
24	days / students
28	days / teachers

6 Schools Closed - Labor Day

OCTOBER

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Month:	
19	days / students
20	days / teachers
Cumulative:	
43	days / students
48	days / teachers

1 Schools Open - Rosh Hashanah at Sundown
11 Schools Closed - Yom Kippur / Columbus Day
12 Schools Closed - Professsional Learning Day (PLD)
29 Schools Open - Diwali

NOVEMBER

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Month:	
19	days / students
19	days / teachers
Cumulative:	
62	days / students
67	days / teachers

2 Schools Closed - Election Day
11 Schools Open - Veterans' Day
24 Early Release
25 - 26 Schools Closed - Thanksgiving Recess

DECEMBER

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Month:	
15	days / students
16	days / teachers
Cumulative:	
77	days / students
83	days / teachers

6 Schools Closed - Teacher PLD, K-8 Conf
7 Early Release K-8 ONLY - K-8 Conf
9 Elementary Conferences Evening
22 Early Release
23 - 31 Schools Closed - Holiday Recess
25 Christmas Day (Holiday Recess)

JANUARY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Month:	
20	days / students
20	days / teachers
Cumulative:	
97	days / students
103	days / teachers

1 New Year's Day (Holiday Recess)
3 School Resumes
17 Schools Closed - Dr Martin Luther King, Jr Day
25 Early Release - Teacher Collab
26 Schools Open - Lunar New Year

FEBRUARY

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29				

Month:	
15	days / students
15	days / teachers
Cumulative:	
112	days / students
118	days / teachers

14-18 Schools Closed - Winter Recess
21 Schools Closed - President's Day
26 Eid al-Fitr

MARCH

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Month:	
23	days / students
23	days / teachers
Cumulative:	
135	days / students
141	days / teachers

6 Early Release K-5 ONLY - K-5 Conf.
15 Early Release K-5 ONLY - K-5 Conf.
21 Early Release - Gr 6-12 Teacher Collab; K-5 Conf

APRIL

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Month:	
15	days / students
15	days / teachers
Cumulative:	
150	days / students
156	days / teachers

10 - 14 Schools Closed - Spring Recess
14 Schools Closed - Good Friday

MAY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Month:	
22	days / students
22	days / teachers
Cumulative:	
172	days / students
178	days / teachers

5 Schools Open - Eid al-Adha
26 Early Release
29 Schools Closed - Memorial Day

JUNE

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Month:	
8	days / students
9	days / teachers
Cumulative:	
180	days / students
187	days / teachers

GHS Graduation: TBD
9 Last Day for Grade 6&9
12 Last Day for Other Students
13 Last Day for Staff
19 Last Day for Students w/ 5 Snow Days**
20 Last Day for Staff w/ 5 Snow Days**

JULY

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Summer School Dates: TBD

** If more snow/storm days are needed, they will be taken from either the remaining days in June or from Spring Recess in April. Please plan accordingly.

180 Days / Students, 187 Days / Teachers

Note: There shall be no athletic games or activity competitions, projects, homework, or major assignments the evening before or on recognized and religious holidays, and no instructional assignments required to be worked on during Thanksgiving, Holiday, Winter, and Spring recesses.

SECURE ENTRANCE

EASTERN MIDDLE SCHOOL
51 HENDRIE AVENUE
RIVERSIDE, CT 06878
BID #2588-26

S/P+A PROJECT #24.179

Drawing Number	Drawing Name
	COVER SHEET
G001	ABBREVIATIONS & SYMBOL LEGEND
G002	CODE PLANS & INFORMATION
Environmental Drawings	
HBM-1	FIRST FLOOR HAZARDOUS BUILDING MATERIALS ABATEMENT PLAN
Architectural Drawings	
A110	DEMOLITION PLAN & FLOOR PLAN
A111-A249	NOT USED
A250	REFLECTED CEILING PLANS & DETAILS
A251-A459	NOT USED
A460	INTERIOR ELEVATIONS
A461-A599	NOT USED
A600	RAILING DETAILS
A601-A849	NOT USED
A850	DOOR SCHEDULE, TYPES & DETAILS
Mechanical Drawings	
M001	MECHANICAL ABBREVIATIONS, NOTES & SYMBOLS
M002-M099	NOT USED
M100	MECHANICAL PARTIAL FLOOR PLAN
M101-M299	NOT USED
M300	MECHANICAL DETAILS
Electrical Drawings	
E001	GENERAL NOTES, ABBREVIATIONS & LEGEND
E002-E099	NOT USED
E100	PARTIAL FIRST FLOOR PLANS – LIGHTING
E101-E199	NOT USED
E200	PARTIAL FIRST & SECOND FLOOR PLANS – POWER
E201-E599	NOT USED
E600	DETAILS
Technology Drawings	
T001	GENERAL NOTES, ABBREVIATIONS & LEGEND
T002-T099	NOT USED
T100	PARTIAL FIRST & SECOND FLOOR PLANS – TECHNOLOGY
T101-T599	NOT USED
T600	DETAILS

END OF DRAWING LIST

SECTION 011000 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 PROJECT DESCRIPTION

A. The Work of the Project is defined by the Contract Documents and consists of the interior renovations of an existing building's vestibule to create a secure entrance.

1.3 CONTRACTOR USE OF SITE AND PREMISES

A. Limited Use of Site: Limit use of the premises to construction activities in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

B. Confine operations to as small work areas and accessways as possible. As much as possible and without damage to the finishes, doors, and related building systems, access the project area via the service doors designated by Owner.

C. Keep driveways and entrances serving the premises clear and available to the Owner and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

D. Maintain existing egress patterns, exit doors, and means of egress during construction, which will include the provision of temporary walkways, sidewalks, or other means necessary to provide adequate life safety for the building occupants, particularly at exitways which must continue to be open and serviceable while adjacent construction activity occurs.

E. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1. Contractor is responsible to secure project area/site from intrusions during unoccupied (after hours) period of time. Any temporary doors and/or window coverings that may be necessary to complete repairs are the Contractors responsibility to furnish and install as part of the project scope.

1.4 OWNER OCCUPANCY

A. Full Owner Occupancy: The Owner's administrative and maintenance staff will occupy the site and existing building during the entire construction period, with children on site during the school year. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations. Pre-schedule construction operations with the Owner for areas that must be evacuated for extended periods, giving the Owner the opportunity to relocate administrative or educational operations to non-affected areas.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.5 SPECIAL REQUIREMENTS

A. The Contractor shall insure that all work performed is done so in a safe manner and that all his/her employees shall adhere to all applicable safety procedures and practices at all times. There may be children and staff in the vicinity of the work area during normal working hours. The Contractor shall be aware at all times that additional safety considerations should be taken. Particular care shall be taken by the Contractor, Subcontractors and all those in their employ, that all tools, equipment, ladders, etc. are never left unsupervised.

B. Meaningful Instruction: Meaningful instruction (as determined by the Owner) must be facilitated and possible within the building at all times. This requirement may limit the Contractor's demolition and construction operations as the distraction represented by hammering, material movement, etc. may disrupt classes. No down time or mobilization charges will be permitted should the meaningful instruction requirement suspend the Contractor's operations for any length of time.

C. Testing: During the school year, Smarter Balanced Assessment Consortium may be administered to portions of the student population, which requires absolute concentration on the part of the students. The Owner may prohibit operations during the administration of these assessments. Cooperate with the Owner to determine the schedule, locations of the testing and where operations may proceed with disrupting classroom or roofing operations.

D. Under no circumstances shall the buildings' occupants be subjected to excessive construction noise or vibrations, nor shall they be subject to fumes, odors, or other deleterious effects of the operation. Should material delivery, demolition or construction operations, inclement weather, or related schedule conditions produce this situation (as determined by the Owner), the Contractor shall be required to suspend operations that produce the offending effects until such time as the building is not occupied, or as approved by the Owner.

E. Schedule: Work (meaning shop drawings and procurement) for the project can begin immediately after the contract signing however the on-site construction period cannot begin until school has been dismissed for the summer (June 22, 2027, the earliest). Owner will provide Contractor a 30-day advanced notice of the exact start dates based for each school based on the revised School Calendar adjusted for incorporated snow days.

F. There will be absolutely **no** fraternizing with the students by construction personnel. Anyone caught doing so will be required to leave the jobsite and will not be permitted to return. Such dismissal shall not give the contractor grounds for default on any other contract requirements, including the construction schedule.

G. Site Security – Identification Badges

1. The Contractor shall provide a list of all contact persons. The list shall include each trade, name of Contractor, contact person(s), phone numbers, fax numbers, Federal Employer Identification Number (FEIN), social security number if FEIN is not available, and Connecticut Tax Registration number.
2. Security badges will be worn by all project personnel during construction activities. The Contractor will provide badges at no cost to the Owner. The Contractor will be responsible for monitoring the display of badges, including those of the personnel of all subcontractors and visitors to the project site.

H. Public Health Emergency:

1. The Contractor shall anticipate and incorporate in their Bids all potential costs related to a public health emergency such as the COVID-19/Coronavirus Pandemic, including rules, regulations, and recommendations issued by public authorities. The potential costs may include, but are not limited to, costs related to social distancing, manpower levels, project scheduling, construction coordination, material/product supplies and delivery delays, material escalation costs, increased subcontractor/supplier costs, loss of productivity and inefficiency costs, extended general conditions costs, and any other potential costs.

I. Overtime: The Contractor must include within their Base Bid all overtime, nights, holidays, and weekends as required to meet the Project Completion date.

J. Supervision: The Contractor must provide full-time, properly qualified on-site supervision for the entire duration of the project, while workpersons are on site.

K. Equipment: All equipment and tools to perform work are to be provided by the Contractor. No equipment and tools will be available from the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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 Sections:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

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, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. A list of unit prices is included in the Bid Form and/or Bid Packages.

END OF SECTION 012200

SECTION 012500 - SUBSTITUTION PROCEDURES

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 substitutions.

B. Related Sections:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
2. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

A. Substitution Requests: Submit three (3) 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 comparable form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
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, SIDE-BY-SIDE comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and Owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. 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 date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. 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. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.

1. 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:

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    e. Requested substitution is compatible with other portions of the Work.
    f. Requested substitution has been coordinated with other portions of the Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one (1) 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.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within sixty (60) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. 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:

    a. 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.
    b. Requested substitution does not require extensive revisions to the Contract Documents.
    c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    d. Substitution request is fully documented and properly submitted.
    e. Requested substitution will not adversely affect Contractor's construction schedule.
    f. Requested substitution has received necessary approvals of authorities having jurisdiction.
    g. Requested substitution is compatible with other portions of the Work.
    h. Requested substitution has been coordinated with other portions of the Work.
    i. Requested substitution provides specified warranty.
    j. If requested substitution involves more than one (1) 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

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 handling and processing Contract modifications.

B. Related Sections:

1. Section 016000 "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

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 not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or twenty (20) days, when not otherwise specified, 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.
    e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the 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 Section 012500 "Substitution Procedures" if the proposed change requires substitution of one (1) product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Unit Price Adjustment: Refer to Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. 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.

B. 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 Supplementary Conditions and other Division 01 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:

1. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
4. Section 013300 "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal 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. Submittal schedule.
c. Items required to be indicated as separate activities in 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 (1) 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. Arrange schedule of values consistent with format of AIA Document G703.

3. 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 multiple line items for principal subcontract amounts in excess of five percent (5%) of Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
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 required, include evidence of insurance.

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 Sum.

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. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 or comparable 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
5. Include updated and approved Contractor’s construction schedule, potential Change Order Log and Product Submittal Log.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Materials previously stored and included in previous Applications for Payment.
    b. Work completed for this Application utilizing previously stored materials.
    c. Additional materials stored with this Application.
    d. Total materials remaining stored, including materials with this Application.

F. 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 (1) 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.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. 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 (preliminary if not final).
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of pre-construction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing one hundred percent (100%) 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.

J. 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 Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination drawings.
4. Requests for Information (RFIs).
5. Project meetings.

B. Related Sections:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.4 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 (1) part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

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 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. Pre-installation conferences.
7. Startup and adjustment of systems.
8. 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. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one (1) entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple Contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts, and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

4. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1¼-inch-diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

5. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.
6. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Section 013300 "Submittal Procedures."

1.6 KEY PERSONNEL

A. 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, office, and cellular telephone numbers and email addresses. 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.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

    1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
    2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or comparable form.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Architect's actions on submittals.
    f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

A. General: 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: General Contractor or Construction Manager is responsible for recording significant discussions and agreements achieved. General Contractor or Construction Manager is also responsible for distributing the meeting minutes to everyone concerned including Owner and Architect, within three (3) days of the meeting.

B. Pre-construction Conference: Schedule and conduct 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.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Construction Administrator, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Preparation of record documents.
    m. Work restrictions.
    n. Working hours.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Procedures for moisture and mold control.
    r. Procedures for disruptions and shutdowns.
    s. Construction waste management and recycling.
    t. Parking availability.
    u. Office, work, and storage areas.

v. Equipment deliveries and priorities.
w. First aid.
x. Security.
y. Progress cleaning.

4. Minutes: General Contractor or Construction Manager is responsible for recording and distributing meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation 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 of the progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Possible conflicts.
i. Compatibility problems.
j. Time schedules.
k. Weather limitations.
l. Manufacturer's written recommendations.
m. Warranty requirements.
n. Compatibility of materials.
o. Acceptability of substrates.
p. Temporary facilities and controls.
q. Space and access limitations.
r. Regulations of authorities having jurisdiction.
s. Testing and inspecting requirements.
t. Installation procedures.
u. Coordination with other work.
v. Required performance results.
w. Protection of adjacent work.
x. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring 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. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than thirty (30) days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for demonstration and training.
    f. Preparation of Contractor's punch list.
    g. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    h. Submittal procedures.
    i. Responsibility for removing temporary facilities and controls.

4. Minutes: General Contractor or Construction Manager is responsible for recording and distributing meeting minutes.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. 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) Progress cleaning.

10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: General Contractor or Construction Manager is responsible for recording and distributing meeting minutes.

   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 Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Daily construction reports.
3. Material location reports.
4. Field condition reports.
5. Special reports.

B. Related Sections:

1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "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 Activity: An activity on the critical path that 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. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. 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.

F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF electronic file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

C. Daily Construction Reports: Submit at weekly intervals.

D. Material Location Reports: Submit at weekly intervals.

E. Field Condition Reports: Submit at time of discovery of differing conditions.

F. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Pre-scheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Discuss constraints, including phasing, work stages and area separations.
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, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or 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 sixty (60) days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include not less than fifteen (15) 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.
6. Punch List and Final Completion: Include not more than thirty (30) days for punch list and final completion.

C. 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. Phasing: Arrange list of activities on schedule by phase.
2. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Uninterruptible services.
    c. Use of premises restrictions.
    d. Provisions for future construction.
    e. Seasonal variations.
    f. Environmental control.

3. 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. Fabrication.
    e. Sample testing.
    f. Deliveries.

g. Installation.
h. Tests and inspections.
i. Adjusting.
j. Curing.
k. Startup and placement into final use and operation.

4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Completion of mechanical installation.
b. Completion of electrical installation.
c. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion**.**

E. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Section 012900 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

G. Recovery Schedule: When periodic update indicates the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's 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.

1. For construction activities that require three (3) months or longer to complete, indicate an estimated completion percentage in ten percent (10%) increments within time bar.

2.3 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, including presence of rain or snow.
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. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. 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 Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one (1) day 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 one (1) week before each 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 final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Construction Administrator, 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 013233 - PHOTOGRAPHIC DOCUMENTATION

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 the following:

1. Periodic construction photographs.

B. Related Sections:

1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three (3) days of taking photographs.

1. Submit photos by uploading to web-based Project management software site.

1.4 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with date, Project area, and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum depth of field and in focus. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.
2. Field Office Images: Maintain one (1) set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

B. Periodic Construction Photographs: Take eighteen to twenty (18-20) photographs weekly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

C. Additional Photographs: Architect may request photographs in addition to periodic photographs specified.

1. In emergency situations, take additional photographs within 24 hours of request.
2. Circumstances that could require additional photographs include, but are not limited to, the following:

a. Immediate follow-up when on-site events result in construction damage or losses.
b. Substantial Completion of a major phase or component of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Submit concurrently with Contractor’s construction schedule. Include submittals required during the first sixty (60) days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action, informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of the CAD Drawings will **not** be provided by Architect for Vendor’s use in preparing submittals unless requested and Architect’s user agreement properly completed.

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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. 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. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow ten (10) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow ten (10) days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow fifteen (15) days for initial review of each submittal.

D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Name of subcontractor.
    f. Name of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Include the following information on an inserted cover sheet:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Contractor.
    e. Name of firm or entity that prepared submittal.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Related physical samples submitted directly.
    m. Other necessary identification.

5. Include the following information as keywords in the electronic file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

F. Options: Identify options requiring selection by the Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

I. Transmittal: Assemble 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. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Indication of full or partial submittal.
j. Drawing number and detail references, as appropriate.
k. Transmittal number**,** numbered consecutively.
l. Submittal and transmittal distribution record.
m. Remarks.
n. Signature of transmitter.

2. 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 in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

K. 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.

L. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

    a. Architect will return annotated file. Annotate and retain one (1) copy of file as an electronic Project record document file.

2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
3. Certificates and Certifications Submittals: Provide a 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.

    a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

4. Test and Inspection Reports Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

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 published 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 catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

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: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8½ by 11 inches but no larger than 30 by 42 inches.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one (1) submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.

3. 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 the 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.

E. Product Schedule: As required in individual Specification Sections, 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 indicated in the Contract Documents.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Section 012900 "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.

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person Include lists of completed projects with project names and addresses, contact information of Architects and Owners, and other information specified.

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. 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.

R. Research Reports: Submit 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.

S. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."

T. Pre-construction Test Reports: Submit 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 in the Contract Documents.

U. Compatibility Test Reports: Submit 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.

V. Field Test Reports: Submit reports 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 in the Contract Documents.

W. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Section 017700 "Closeout Procedures."

C. 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.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents may 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 Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. 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 work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:

1. Divisions 02 through 49 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. Contractor’s quality-control services do not include contract enforcement activities performed by Architect.

C. Pre-construction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

D. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

F. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. 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. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

I. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two (2) or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction 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.

1.6 ACTION SUBMITTALS

A. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.7 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: 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.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, 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.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within ten (10) days of Notice to Proceed, and not less than five (5) days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as non-conforming or defective. Indicate corrective actions taken to bring non-conforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical 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.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. 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.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, 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.

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 product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections 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. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

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 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. 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.

1.11 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, 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 Sum will be adjusted by Change Order.
3. Costs for testing that is cancelled will be charged to the Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify that the Work complies with requirements.

1. 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.
2. 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.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. 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 Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. 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.

F. Testing Agency Responsibilities: Cooperate with Architect 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.

G. Associated Contractor Services: Cooperate with agencies and representatives 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 inspection. 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.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

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.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency 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, 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 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.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 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 or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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 Supplementary Conditions and other Division 01 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," "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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

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.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

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.

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's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.

38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; www.ec.europa.eu/growth/single-market/ce-marking.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTA - Consumer Technology Association; www.cta.tech.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
72. DHI - Door and Hardware Institute; www.dhi.org.
73. ECA - Electronic Components Association; (See ECIA).
74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; www.ecianow.org.
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); www.intertek.com.
82. EVO - Efficiency Valuation Organization; www.evo-world.org.
83. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmglobal.com.

87. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; www.greenseal.org.
94. HI - Hydraulic Institute; www.pumps.org.
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Association; www.theicpa.com.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; www.itu.int.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHI - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; (See NSI).
131. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.

137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
139. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
140. NBI - New Buildings Institute; www.newbuildings.org.
141. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
142. NCMA - National Concrete Masonry Association; www.ncma.org.
143. NEBB - National Environmental Balancing Bureau; www.nebb.org.
144. NECA - National Electrical Contractors Association; www.necanet.org.
145. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
146. NEMA - National Electrical Manufacturers Association; www.nema.org.
147. NETA - InterNational Electrical Testing Association; www.netaworld.org.
148. NFHS - National Federation of State High School Associations; www.nfhs.org.
149. NFPA - National Fire Protection Association; www.nfpa.org.
150. NFPA - NFPA International; (See NFPA).
151. NFRC - National Fenestration Rating Council; www.nfrc.org.
152. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
153. NHLA - National Hardwood Lumber Association; www.nhla.com.
154. NLGA - National Lumber Grades Authority; www.nlga.org.
155. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
156. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
157. NRCA - National Roofing Contractors Association; www.nrca.net.
158. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
159. NSF - NSF International; www.nsf.org.
160. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
161. NSPE - National Society of Professional Engineers; www.nspe.org.
162. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
163. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
164. NWFA - National Wood Flooring Association; www.nwfa.org.
165. NWRA - National Waste & Recycling Association; www.wasterecycling.org
166. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
167. PDI - Plumbing & Drainage Institute; www.pdionline.org.
168. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
169. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
170. RFCI - Resilient Floor Covering Institute; www.rfci.com.
171. RIS - Redwood Inspection Service; www.redwoodinspection.com.
172. SAE - SAE International; www.sae.org.
173. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
174. SDI - Steel Deck Institute; www.sdi.org.
175. SDI - Steel Door Institute; www.steeldoor.org.
176. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
177. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
178. SIA - Security Industry Association; www.siaonline.org.
179. SJI - Steel Joist Institute; www.steeljoist.org.
180. SMA - Screen Manufacturers Association; www.smainfo.org.
181. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
182. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
183. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
184. SPIB - Southern Pine Inspection Bureau; www.spib.org.
185. SPRI - Single Ply Roofing Industry; www.spri.org.
186. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.

187. SSINA - Specialty Steel Industry of North America; www.ssina.com.
188. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
189. STI - Steel Tank Institute; www.steeltank.com.
190. SWI - Steel Window Institute; www.steelwindows.com.
191. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
192. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
193. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
194. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
195. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
196. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
197. TMS - The Masonry Society; www.masonrysociety.org.
198. TPI - Truss Plate Institute; www.tpinst.org.
199. TPI - Turfgrass Producers International; www.turfgrasssod.org.
200. TRI - Tile Roofing Institute; www.tileroofing.org.
201. UL - Underwriters Laboratories Inc.; www.ul.com.
202. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
203. USAV - USA Volleyball; www.usavolleyball.org.
204. USGBC - U.S. Green Building Council; www.usgbc.org.
205. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
206. WA - Wallcoverings Association; www.wallcoverings.org.
207. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
208. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
209. WDMA - Window & Door Manufacturers Association; www.wdma.com.
210. WI - Woodwork Institute; www.wicnet.org.
211. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
212. WWPA - Western Wood Products Association; http://www.wwpa.org.

B. 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. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. 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. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.

12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

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 Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary support, security, and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary of Work" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, utility hookups, staging areas, construction site entrances, and parking areas for construction personnel.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

1.5 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. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices: Pre-fabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Unit must be large enough for regular job meetings, plan review areas, submittal storage and other job file and administrative functions.

1. If provided, Contractor will be responsible for its complete installation per code and authority having jurisdiction.
2. No building space will be provided by the Owner for the Contractor’s field office.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Sheds to be metal box storage units or have wood floors raised above the ground.
2. Store combustible materials apart from building.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

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. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

E. Electronic Communication Service: Regardless of availability of Owner's service, the Contractor shall maintain at his expense secure and reliable WiFi wireless connection to internet with provisions for access by Architect, the Owner's staff, Municipal Officials or Inspectors, and all subcontractors.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary field offices and sheds located within construction area or within 30 feet of building lines that is non-combustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. 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.

C. Parking: Provide temporary parking areas for construction personnel.

D. Project Signs: Provide Project signs as required by Owner. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs so they are legible at all times.

E. 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 progress cleaning requirements in Section 017300 "Execution."

F. Existing Elevator Use: Use of elevators for construction activities is not permitted.

G. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

E. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

F. 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.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

B. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

C. 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. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

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 selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Sections:

1. Section 012500 "Substitution Procedures" for requests for substitutions.
2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained 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. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process 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. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," 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 additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one (1) 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 Section 013300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two (2) or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

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

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 and vandalism. 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 determine compliance with the Contract Documents and to determine 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. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
5. Protect stored products from damage and liquids from freezing.

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: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for 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 indicated form properly executed.
3. Refer to Divisions 02 through 49. Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, 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 non-standard 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. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one (1) of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
b. Non-Restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one (1) of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one (1) of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
b. Non-Restricted List: Where Specifications include a list of available manufacturers, provide a product by one (1) of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one (1) of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one (1) of the other named manufacturers.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require 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, SIDE-BY-SIDE 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.
6. Comply with requirements of Section 012500 “Substitution Procedures”.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Installation of the Work.
2. Cutting and patching.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.
6. Correction of the Work.

B. Related Sections:

1. Section 013300 "Submittal Procedures" for submitting surveys.
2. Section 017700 "Closeout Procedures" for submitting recording of Owner-accepted deviations from indicated lines and levels and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of utilities and construction indicated as existing are not guaranteed.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, 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. 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.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 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 96 inches in occupied spaces and 90 inches in unoccupied spaces.

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. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

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.

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.

3.4 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Empty or remove dumpsters at the end of each work week. 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 waste materials more than seven (7) days during normal weather or three (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.

    a. Utilize containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where more than one (1) installer has worked.

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: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

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.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

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: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.7 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.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

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 017700 - CLOSEOUT PROCEDURES

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 contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Sections:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
3. Section 017300 "Execution" for progress cleaning of Project site.
4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
6. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.
7. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in 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 with 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 photographic documentation, 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 heat and other 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, 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 final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "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. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
5. Secure and provide both temporary and final Certificate of Occupancy from the Building Official, meeting all local and state permit closeout requirements.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, 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. Organization 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. Use **CSI Form 14.1A** or comparable form.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. 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.

4. Submit list of incomplete items in the following format:

    a. PDF electronic file. Architect will return annotated file.

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. 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, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½-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.
4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

C. 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: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and anti-pollution 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 after final acceptance of the entire Project or for a designated portion of Project:

a. Clean Project site 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
i. Vacuum and mop concrete.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
o. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls".

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

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 Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. 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. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Sections:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Divisions 02 through 49 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 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. Two (2) thumb drives. Enable review comments on draft submittals.
2. Two (2) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return both copies to be given to the Owner.

C. Initial Manual Submittal: Submit draft copy of each manual at least thirty (30) days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least fifteen (15) days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or modify each manual to comply with Architect's comments. Submit copies of each corrected manual within fifteen (15) days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8½-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 (2) 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, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. 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 storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8½-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.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: 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: 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 and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. 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 (1) 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 (1) system into a single binder.

1.7 EMERGENCY MANUALS

A. 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.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. 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.

D. 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.

E. 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.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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.

B. 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. Use designations for systems and equipment indicated on Contract Documents.
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.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.

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.

D. 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.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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

B. 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.

C. 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 and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; 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 (1) 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.

    a. 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.

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.

E. 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.

F. 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.

G. 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.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. 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.

J. 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 maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. 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.

C. 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 and drawing or schedule designation or identifier where applicable.

D. 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.

E. 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.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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 Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Sections:

1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one (1) set(s) of marked-up record prints.

B. Record Specifications: Submit one (1) paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one (1) paper copy of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one (1) set of marked-up paper copies 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 provide information for preparation of corresponding 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 acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

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. Revisions to routing of piping and conduits.
d. Revisions to electrical circuitry.
e. Actual equipment locations.
f. Duct size and routing.
g. Locations of concealed internal utilities.
h. Changes made by Change Order or Construction Change Directive.
i. Changes made following Architect's written orders.
j. Details not on the original Contract Drawings.
k. Field records for variable and concealed conditions.
l. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
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. Format: Paper copy.
3. 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.

B. Format: Submit record Specifications as paper copy.

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.

B. Format: Submit record Product Data as paper copy.

1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one (1) 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 Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. 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:

1. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and 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. Indicate proposed training modules utilizing manufacturer-produced demonstration for systems, equipment, and products **in lieu of** video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-Instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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 for equipment not part of a system, as required by individual Specification Sections.

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 as applicable to the system, equipment, or component:

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 has 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 training manual organized in coordination with requirements in Section 017823 "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis-of-system-design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish Contractor with names and positions of participants.

C. 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 with at least seven (7) days advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test and ask Owner to sign-off on for acceptance.

E. 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 024119 - SELECTIVE 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 selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary of Work" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Remove and Replace: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled. Provide and install new items as specified.

E. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

F. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

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 PRE-INSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building.

C. Pre-demolition Photographs: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is included elsewhere in the Contract Documents 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.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing conditions and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

1. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

C. 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 selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. All removed materials and rubbish shall be constantly sprinkled with water or other dusting agent to mitigate dust. Provide drop cloths or other type of coverings to prevent infiltration of dust to other parts of the existing building.
9. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

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.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 028200 - SELECTIVE HAZARDOUS BUILDING MATERIALS ABATEMENT DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide selective demolition to remove materials as outlined by the architects scope of work for demolition. Some materials may be removed, set aside and reinstalled after work completion (ceiling tiles, etc.). Materials that may be demolished include existing carpeting/multiple layers of flooring/ wood/concrete and demolish ceilings/walls/floors/doors /millwork/shelving/ countertops/window systems/door systems/concrete/boilers/chases/ mechanical systems/ductwork/piping/roofing/ masonry/stone/ brick/wall and ceiling systems/ raised flooring/wall materials (bulletin/chalk/white /etc. boards, mirrors), non-moveable objects, etc. as necessary to access all asbestos/ PCB/other hazardous containing materials as specified herein, and as required for complete and proper abatement.

B. The hazardous building materials contractor (contractor) will be responsible for performing selective interior demolition in portions of the building that is scheduled for renovation (only demolish materials scheduled for selective demolition/demolition). Contractor shall open up walls, chases and ceilings to check for hidden piping and ductwork (as required for entire building in areas of work – prior to start of abatement work) as well as demolishing millwork, cabinetry, all non-moveable objects, walls, chases etc. to located potential asbestos containing flooring materials and other suspect asbestos containing materials that may be hidden, buried or inaccessible.

C. The contractor(s) will be responsible for hiring an engineer and other appropriate personnel to ensure that all required selective demolition and demolition activities are safe to perform for all personnel on site. The contractor(s) will be financially responsible for any damage that may occur to the site, on-site personnel, fines, penalties, etc. They will also be responsible for paying/reimbursing all legal fees/costs for all parties involved with the project should selective demolition or demolition activities cause injury or death to any persons on site.

D. Please note there are several layers of flooring, ceilings, walls, chases, non-moveable objects requiring demolition to access all asbestos containing materials, some of which are contaminated with asbestos/PCBs and require disposal as such.

E. Required permits shall be obtained by the Contractor at no additional cost to the Owner.

F. Notes: Contractor is responsible for removing all asbestos containing materials (behind walls, ceilings, windows, chases, doors, windows, concrete, brick, non-moveable objects, etc.) in selective demolition/demolition areas as noted by the architect's specifications and drawings.

G. The contractor will be required to remove carpeting and other flooring, wood floors, classroom wall and ceiling structures, raised flooring, multiple layers of mixed flooring to gain access to the asbestos flooring and/or mastic and carpet adhesives in all areas. There are more than one layer of flooring in most locations. All layers of floor tile, leveling materials, mastic, concrete, wood, thinset, sheet flooring, rubber, rolled or poured flooring, carpet adhesives, etc. are included in the base work, no extra change will be accepted. Demolition or moving typical non-movable objects by the abatement contractor is required to gain access to all flooring materials to be removed. SD sheets for chemicals to be used during the project must be submitted to the owners' representative prior to site delivery.

H. The contractor will be required to remove roofing, window and door systems, mechanical systems, flooring, walls, ceilings, wall applications/masonry, brick, concrete, glazed block, millwork, shelving and cabinetry to access all asbestos containing materials for abatement/remediation and packaging for recycling/removal/abatement and disposal.

I. Related Sections:

1. Section 028213 – Asbestos Abatement
2. Section 028313 – Lead-Based Paint Awareness
3. Section 028416 – Universal Waste Removal and Recycling
4. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 PROJECT CONDITIONS

A . Occupancy:

1. Areas of the buildings in which selective demolition/demolition will occur will be unoccupied during work.

B. Existing Conditions:

1. After the project is begun, the Contractor is responsible for the condition of the structures to be selectively demolished.
2. Unforeseen Conditions: Should unforeseen conditions be encountered that affect design or function of project, investigate and fully submit an accurate, detailed, written report to the office of the Consultant. While awaiting a response, reschedule operations if necessary to avoid delay of overall project.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and sealed.

B. Insofar as is practicable, arrange operations to reveal unknown or concealed conditions for examination and verification before removal or demolition.

C. Verify actual conditions to determine, in advance, whether removal or demolition of any element will result in structural deficiency, overloading, failure, or unplanned collapse.

1. Demolish and remove connections to all electrical gas, and plumbing fixtures required to remove asbestos containing materials.

3.2 PREPARATION

A. Traffic: Do not obstruct walks or public ways without the written permission of governing authorities and of the Owner. Where routes are permitted to be closed, provide alternate routes if required.

B. Protection:

1. Provide for the protection of persons passing around or through the area of demolition.
2. Perform demolition so as to prevent damage to adjacent improvements and facilities to remain.
3. Protect walls, floors, and other new or existing work from damage during demolition operations.

C. Damages: Without cost to the Owner and without delay, repair any damage caused to facilities to remain.

3.3 POLLUTION CONTROLS

A. Control as much as practicable the spread of dust and dirt.

B. Observe environmental regulations.

C. Do not allow water usage resulting in freezing or flooding.

D. Do not allow adjacent improvements to remain to become soiled by demolition operations.

3.4 DEMOLITION - GENERAL

A. Remove: Items indicated to be removed shall be removed by the Contractor.

B. Existing to Remain: Construction or items indicated to remain shall be protected against damage during demolition operations. Where practical, and with the Owner's permission, the Contractor may elect to remove items to a suitable storage location during demolition and then properly clean and reinstall the items.

C. Perform work in a systematic manner.

D. Demolish and remove existing construction only to the extent required, as indicated in the Contract Documents.

E. Perform selective demolition using methods that are least likely to damage work to remain and which will provide proper surfaces for patching.

F. Remove debris daily.

G. Use any methods permitted by governing regulations and the requirements of the Contract Documents.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of materials resulting from demolition operations. Non-contaminated material (materials not containing residue asbestos, lead, PCB or other hazardous, regulated or special waste) may be disposed of as construction waste. Do not allow materials to accumulate on site.

B. All rubbish and waste material from the Work shall be neatly stacked or kept in suitable containers and removed from the premises daily. The premises shall be kept clean and in an orderly condition at all times to the satisfaction of the Owner and the Consultant.

C. Transport materials resulting from demolition operations and legally dispose of off-site.

D. Off-site disposal location shall not be within one-half mile of any portion of the project site or within sight of the project site.

E. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

3.6 CLEANING

A. Throughout the construction period, the Contractor shall maintain the building and site free of rubbish, debris, surplus materials, and other items not required for the Work.

B. Remove such material from the site daily to prevent accumulations.

C. Remove all construction debris from work areas, and remove all hazardous waste and asbestos waste as required by the most current federal, state, and local regulations and the requirements of the specifications.

END OF SECTION 028200

SECTION 028213 - ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

B. Sections containing requirements related to this Section include, but are not limited to:

1. Section 028200 – Selective Hazardous Building Materials Abatement Demolition
2. Section 028313 – Lead-Based Paint Awareness
3. Section 028416 – Universal Waste Removal and Recycling
4. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 CONSULTANT

A. The Owner shall retain Langan for the purposes of project management and monitoring during Asbestos Abatement. The Consultant will represent the Owner in all phases of the abatement project at the discretion of the Owner. The Asbestos Abatement Contractor will regard the Consultant's direction as authoritative and binding as provided herein, in matters particularly but not limited to approval of work areas, review of monitoring results, completion of the various segments of work, final completion of the abatement, submission of data, and daily field punch list items. The State of Connecticut licensed Asbestos Consultant — Project Designer is Matthew Myers (license no. 000058).

1.3 USE OF THE CONTRACT DOCUMENTS

A. It shall be incumbent upon the Contractor to visit the Site and determine what exists, its condition, and what will be required to accomplish the Work intended by the Contract Documents. No increase in the Contract Sum will be permitted as a result of the Contractor's failure to visit the Site and understand the existing conditions.

B. All work shall comply with the Contract Documents and with applicable Codes, laws, regulations, and ordinances wherever applicable. The most stringent of all the foregoing shall govern.

C. It is not intended that the Specifications show every detail of the Work, but the Contractor shall be required to furnish within the Contract Sum all material and labor necessary for the completion of the Work in accordance with the intent of the Specifications.

D. In case of ambiguity among the Contract documents, the more stringent requirement as determined by the Consultant shall prevail.

E. The Work of this Contract includes making modifications as necessary, subject to approval by Owner in consultation with the Consultant, to correct any conflicts.

F. All items, not specifically mentioned in the Specifications but implied by trade practices to complete the work, shall be included.

G. This specification and drawings cover the proper and legal removal and disposal of all asbestos-containing materials (ACM) and asbestos contaminated waste from the Eastern Middle School security entryway renovation project site located in Greenwich, Connecticut. The abatement

activities shall comply with all aspects of the contract documents and Federal, State and local requirements.

H. Whenever there is a conflict or overlap within these specifications and between applicable codes and regulations, the most stringent provision specified shall apply.

1.4 EXAMINATION OF THE SITE

A. It is understood that the Contractor has examined the Site and made his own estimates of the facilities and difficulties attending the execution of the Work and has based his price thereon.

B. Except for unforeseeable concealed conditions as determined by the Consultant, the Contractor shall make no claim for additional cost due to the existing conditions at the Site.

1.5 CONTRACTOR QUALIFICATIONS

A. All bidders shall submit a record of prior experience in asbestos abatement projects, listing no less than three (3) completed jobs in the past year, with all projects of similar size and scope. The Contractor shall list the experience and training of the project foremen and all on-site personnel. The information that should be included is as follows:

1. Project Name and Address
2. Owner's Name and Address
3. Architect/Consultant
4. Contract Amount
5. Date of Completion
6. Extras and Changes

B. The Contractor selected must appear on the approved list of Asbestos Abatement contractors on file at the State of Connecticut Department of Public Health (CT DPH) and hold a valid license for asbestos abatement within the State of Connecticut.

C. Submit a written statement regarding whether the Contractor has ever been found out-of-compliance with federal or state asbestos and/or lead regulations pertaining to worker protection, removal, transport, or disposal.

D. The Contractor shall be responsible for obtaining all necessary or required permits from the Federal, State and local agencies having jurisdiction over this asbestos abatement project. Failure on behalf of the Contractor to obtain these permits shall not result in any extension for the timely results of completion of the work set forth in the Contract. The Contractor shall be responsible and shall be required to pay any administrative penalties imposed on the owner for actions taken or lack thereof by the Contractor.

E. Work includes any and all selective demolition and protective measures required to access and remove ACM and maintain a safe working environment.

F. Upon completion of asbestos removal, the contractor shall provide completed, signed and notarized statements indicating that all asbestos-containing materials identified in the scope of work and project description (Section 1.08 and 1.09) were properly removed and disposed of in accordance with applicable Federal, State, and local regulations.

G. All contractors submitting a bid for this work shall visit the work site, attend a pre-bid meeting and walk-through, to be scheduled by the Owner, and be familiar with the work in its entirety. The contractors pre-meeting attendance and bid submission affirms his/her acceptance of the work, site, and building conditions as is.

H. All Contractor personnel involved with asbestos removal work must be thoroughly familiar with the standard operating procedures of the Contractor for removal work as well as all applicable Federal and State regulations governing asbestos removal work.

I. The Supervisor and Asbestos Abatement workers shall be accredited in accordance with EPA regulation 40 CFR Part 763, subpart E, Appendix C; and CT DPH regulations as outlined in Section 19a-332a-1 through 19a-332a-16 (Standards for Asbestos Abatement), and Section 20-440-1 through 20-440-9 (Licensure and Training Requirements for Persons Engaged in Asbestos Abatement and Consulting Services).

J. The Contractor shall be aware of all conditions of the Project and is responsible for verifying quantities and locations of all Work to be performed. Failure to do so shall not relieve the Contractor of its obligation to furnish all labor and materials necessary to perform the work. Any discrepancies noted shall be brought to the attention of the Owner and Engineer prior to bidding the project. No claims for extras shall be made during construction/abatement /demolition.

K. Work includes necessary selective demolition and protective measures required to access and remove ACM and maintain a safe working environment. Asbestos containing materials that would be impacted by selective demolition of wall, ceiling and floor cavities shall be performed within negative pressure enclosure.

L. It is the sole responsibility of the Contractor to determine what, if any patents are applicable to the Project. The Contractor will pay all royalties and/or license fees and will defend all suits or claims for infringement of any patent rights and save the Owner, Architect, Asbestos Safety Control Monitor, Design Sub-Consultant, and Construction Manager harmless from loss, including attorney's fees, on account thereof.

M. The Contractor shall coordinate with the Consultant and maintain the project schedule.

N. The abatement contractor shall hold and document daily pre-abatement safety toolbox meeting to review safe work practices and emergency communication program for the project. The abatement contractor's supervisor and the consultant's project monitor must also ensure that proper fire extinguishing equipment is present. The supervisor shall be knowledgeable in use of fire extinguishing equipment, and emergency exit plans.

1.6 TESTING LABORATORY SERVICES

A. The Contractor shall submit to the Consultant the name; address and qualifications of proposed laboratories intended to be utilized for sample analysis as required by this section and the laboratories must be approved by CT DPH.

1.7 ADDITIONAL GENERAL REQUIREMENTS

A. The Asbestos Abatement Contractor shall employ a competent Asbestos Abatement Supervisor with at least three (3) years’ experience on projects of similar scope and magnitude who shall be responsible for all work involving asbestos abatement as described in the specifications and defined in applicable regulations and have full time daily supervision of the same. The Supervisor shall be the competent person as defined by OSHA regulations.

B. The Contractor shall allow the work of this contract to be inspected if required by local, state, federal, and any other authorities having jurisdiction over such work. The Contractor shall immediately notify the Owner and Consultant and shall maintain written evidence of such inspection for review by the Owner and Consultant.

C. The Contractor shall incur the cost of all fines resulting from regulatory non-compliance as issued by federal, state, and local agencies. The Contractor shall incur the cost of all work requirements mandated by federal, state, and local agencies as a result of regulatory non-compliance or negligence.

D. The Contractor shall immediately notify the Owner and Consultant of the delivery of all permits, licenses, certificates of inspection, of approval, or occupancy, etc., and any other such instruments required under codes by authorities having jurisdiction, regardless of who issued, and shall cause them to be displayed to the Owner and Consultant for verification and recording.

1.8 SCOPE OF WORK

A. This specification and drawing HBM – 01 cover the proper and legal removal and disposal of all asbestos-containing materials (ACM) and asbestos contaminated waste to be impacted by renovation activities from the Eastern Middle School security entryway renovation project site located in Greenwich, Connecticut. The abatement activities shall comply with all aspects of the contract documents and Federal, State and local requirements. There is interior friable asbestos-containing materials (thermal system insulation) identified on the site. Universal wastes are located throughout areas of renovation.

1.9 PROJECT DESCRIPTION

A. Eastern Middle School was constructed in 1968. The school is a two-story building and is approximately 108,000 square feet.

B. The base bid includes the removal and disposal of all asbestos containing materials as identified herein, and on the architects drawings by workers meeting requirements of OSHA 1926.1101 for Class 1 and 2 work. The base bid will include the cost for removal and disposal of asbestos-containing pipe and pipe fitting insulation. Work includes filing and permitting all necessary applications, notifications, requirements and fees; insurance; necessary design services; providing skilled, licensed and certified labor; materials; and equipment necessary for proper preparation, handling, removal and legal disposal of all asbestos-containing materials and asbestos contaminated waste from the subject building in accordance with all requirements of applicable federal, state and local regulations, these specifications and the contract drawings. The following materials and amounts are included in the base bid work.

Base Bid

Material	Location	Estimated Quantity of ACM
Pipe and Pipe Fitting Insulation – Thermal System Insulation	Main Entryway Above Suspended Ceiling Tiles from Perimeter Doors to Interior Corridor Entryway Doors	20 Linear Feet

C. Abatement and Remediation in all areas will start with removing materials at the ceiling level and end with the materials at the flooring level. The hazardous building materials contractor will coordinate and perform enough selective demolition/demolition to access all materials to be removed/abated/remediated (prior to starting abatement). Contractor shall open walls and ceilings to check for hidden piping, ductwork, etc. (as required in areas of work) as well as demolishing millwork, cabinetry, desktops, flooring, all non-moveable objects, walls, chases etc. to locate potential asbestos containing flooring materials and other suspect asbestos containing materials (pipe insulation, etc.) that may be hidden, buried, inaccessible (only

demolish materials scheduled for selective demolition /demolition). Exterior abatement/ remediation will be either removed in containment (interior) or the abatement/remediation contractor will install polyethylene sheeting on the interior of the building and remove materials from the exterior. All ground and roof surfaces must also be protected with tarps, plywood and two layers 10-mil reinforced polyethylene sheeting. This ground protection must extend at least 20 feet away from the building foundation (or farther - enough to prevent building materials from touching unprotected ground and floor surfaces). The contractor will pay for all contamination/remediation/ abatement of interior and exterior surfaces, including ground surfaces if Langan deems they have contaminated these surfaces.

D. The hazardous building materials contractor will be required to perform multiple mobilizations for the abatement/remediation work.

E. Additional materials as discovered outside of those listed will be covered by unit prices if all is not listed as the quantity. Quantities are estimates only and should be verified by the Contractor. Safety data sheets for chemicals to be used during the project must be submitted to the Owner's Representative prior to site delivery. The contractor is responsible for providing temporary water, power, and heat as needed at the site. Temporary lighting/Blast Trac machines/Negative air units within the work areas must be connected to Ground Fault Circuit Interrupter (GFCI) Power Panels installed by a State of Connecticut licensed electrician and located outside of the work areas.

F. The contractor shall be responsible for paying the utility bills for the use of power and water (unless owner agrees to supply at no cost to contractor). However, if any such temporary facilities cannot be provided, it shall be the contractor's responsibility to provide all fixed and temporary connections and hook-ups as well as obtaining permits and paying all fees for making such services available for his work as is necessary. If necessary, the Contractor shall provide temporary services as specified herein, and as required or as necessary to carry out the work. This may include such items as portable generators, water tank trucks, pumps and necessary accessories or the means and equipment and services necessary to temporarily connect to and maintain such services from adjacent utility systems. The use of portable generators will require 24 hour a day, 7 day a week continuous operation if negative air machines in containments are powered by them. This continuous operation must remain in place from the time the pre-abatement visual is completed up until clearance re-occupancy sampling results have passed. The contractor will pay the owner a $2,500 penalty should the power found to not be running the negative air machines in active abatement containments. This penalty will apply daily and the contractor is also responsible for paying all CT DPH fines that may be imposed on the contractor and owner. The contractor shall also comply with any local permits that may be required as well as local noise ordinances.

G. The general/abatement contractors shall only use heavy equipment operators that have proper asbestos and/or HAZWOPER training when disturbing/removing/moving and packing asbestos, lead-based paint and PCB containing materials. Acceptable training for asbestos can be 32 or 40 hour asbestos worker/supervisor with annual refresher training. 40 hour HAZWOPER training and annual refresher training is required for operators handling lead and/or PCB containing/contaminated materials. All operators must also have current medicals, fit test data and wear respirators during work.

H. The remediation/asbestos abatement contractor, their subcontractors, waste transporters and/or landfill(s) do not have permission to take/analyze building materials for PCB content/ concentrations without written permission from the building owner prior to such sampling. Should the contractor or other parties listed above take/analyze PCB samples without the owner’s permission and PCB’s are found to be >1 ppm, the hazardous materials/remediation contractor will be responsible for **all costs** associated with the abatement/ remediation/replacement of all the interior/exterior building materials and adjacent surfaces, including soil/asphalt/concrete/etc.

as well as all costs associated with project delays, attorney fees for all parties affected and all costs resulting from CT DEEP/EPA requirements that may occur as a result.

I. The remediation/asbestos abatement contractor, their subcontractors, waste transporters must submit landfill information to Langan and the owner prior to the shipment of any waste. The contractor(s)/hauler(s) cannot ship waste until Langan and the owner have approved the landfill the contractor/hauler is/are proposing to ship the waste to. PCB TCLP sampling of the waste may be required by the landfills permits and this testing must be performed by the contractor (if testing is approved by Langan and the owner), with Langan present during sampling, and the results made available to Langan and the owner prior to waste shipment. If Langan is not present during the sampling, Langan may perform additional PCB TCLP sampling to confirm the contractor's results and these results will supersede the contractors sample results.

J. The contractor(s) will be responsible for hiring an engineer and other appropriate personnel to ensure that all required selective demolition and demolition activities are safe to perform for all personnel on site. The contractor(s) will be financially responsible for any damage that may occur to the site, on-site personnel, fines, penalties, etc. They will also be responsible for paying/reimbursing all legal fees/costs for all parties involved with the project should selective demolition or demolition activities cause injury or death to any persons on site.

K. The Owner shall retain a Consultant for the purposes of project management and monitoring during asbestos abatement. The Consultant will represent the Owner in all phases of the abatement project at the discretion of the Owner. The asbestos abatement contractor will regard the consultant's direction as authoritative and binding as provided herein, in matters particularly but not limited to approval of work areas, review of monitoring results, completion of the various segments of work, final completion of the abatement, submission of data, and daily field punch list items. The State of Connecticut licensed Asbestos Consultant — Project Designer is Matthew Myers (license no. 000058).

1.10 DEFINITIONS

A. The following definitions relative to asbestos abatement apply:

1. Abatement - Procedures to control fiber release from asbestos-containing materials; includes removal, encapsulation, and enclosure.
2. Air Monitoring - The process of measuring the fiber concentration of an area or of a person.
3. Amended Water - Water to which a surfactant has been added.
4. Asbestos - The name given to a number of naturally occurring fibrous silicates. This includes the serpentine forms and the amphiboles and includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite, or any of these forms, which have been chemically altered.
5. Asbestos Felt - a product made by saturating felted asbestos with asphalt or other suitable bindery, such as a synthetic elastomer.
6. Asbestos Fibers - Those particles with a length greater than five (5) microns and a length to diameter ratio of 3:1 or greater.
7. Asbestos Work Area - a regulated area as defined by OSHA 29 CFR 1926.1101 where asbestos abatement operations are performed which is isolated by physical barriers to prevent the spread of asbestos dust, fibers, or debris. The regulated area shall comply with requirements of regulated area for demarcation, access, respirators, prohibited activities, competent persons and exposure assessments and monitoring.
8. Asphalt Shingles, Composition Shingles or Strip Slates: (Pitched Roof Shingle) - a roofing material manufactured by saturating a dry felt with asphalt then coating the saturated felt with a harder asphalt mixed with a fine mineral, glass fiber, asbestos or organic stabilizer. All or part of the weather side may be covered with mineral granules, or with powdered talc or mica.
9. Base Flashing (roof) - the flashing provided by upturned edges of a water tight membrane on a roof. May contain metal and associated waterproofing material or combination of

roofing felts and waterproofing at the joint between a roofing surface and a vertical surface such as a wall or parapet. Also base flashing may be present at perimeter of completely flat roof.

10. Built-Up Roofing (Composition Roofing, Felt and Gravel Roofing, Gravel Roofing) - a continuous roof covering made up of laminations or plies of saturated or coated roofing felts, alternated with layers of asphalt or coal-tar pitch and surfaced with gravel, paint or finish coat.
11. Caulking - resilient mastic compound often having a silicone bituminous or rubber base; used to seal cracks, fill joints, and prevent leakage. Typical applications: around windows, and doors. Caulking is at joints between two dissimilar materials. (i.e. masonry to wood, masonry to steel)
12. Clean Room - An uncontaminated area or room, which is a part of the worker decontamination enclosure with provisions for storage of workers' street clothes and protective equipment.
13. Clearance Sampling - Final air sampling performed aggressively after the completion of the abatement project in a regulated area.
    Air samples collected by the air sampling professional having a fiber concentration of less than 0.01 fibers/cc of air in each of five (5) samples collected inside the containment will denote acceptable clearance sampling by Phase Contrast Microscopy.
    or
    Five air samples collected inside the containment by the air sampling professional having an average asbestos concentration of less than 70 structures per square millimeter of air will denote acceptable clearance sampling for Transmission Electron Microscopy.
14. Competent Person - As defined by 29 CFR 1926.1101, a representative of the Abatement Contractor who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure. Who has authority to take prompt corrective measures to eliminate such hazards during asbestos removal. Competent person shall be properly trained in accordance with EPA's Model Accreditation Plan.
15. Curtained Doorway - A device to allow ingress and egress from one area to another while permitting minimal air movement between the areas. Two curtained doorways spaced a minimum of six feet apart can form an airlock.
16. Damp Proofing - application of a water impervious material to surface such as wall to prevent penetration of moisture, typically at foundation or below grade surface.
17. Decontamination Enclosure System - A series of connected areas, with curtained doorways between any two adjacent areas, for the decontamination of workers and equipment. A decontamination enclosure system always contains at least one airlock and is adjacent and connected to the regulated area, where possible.
18. Encapsulant - A liquid material which can be applied to asbestos-containing materials which controls the possible release of asbestos fibers from the materials either by creating a membrane over the surface (bridging encapsulant) or penetrating the material and binding its components together (penetrating encapsulant).
19. Equipment Room - Any contaminated area or a room that is part of the worker decontamination enclosure with provisions for storage of contaminated clothing and equipment.
20. Fixed Object - Unit of equipment or furniture in the work areas that cannot be removed from the work area.
21. Friable Asbestos Materials - Any material that contains more than 1% asbestos by weight, that can be crumbled, pulverized or reduced to powder by hand pressure.
22. Glazing Compound - any compound used to hold window glass in place, also referred to as putty, or glazier's putty, is not field applied, usually installed during manufacture of windows.
23. HEPA Filter - High Efficiency Particulate Air (HEPA) filter in compliance with ANSI Z9.2-1979.
24. HEPA Vacuum Equipment - Vacuum equipment equipped with an HEPA filter system for filtering the effluent air from the unit.
25. Movable Object - Unit of equipment of furniture in the work area that can be removed from the work area.

26. Negative Air Pressure Equipment - A portable local exhaust system equipped with HEPA filtration used to create negative pressure in a regulated area (negative with respect to adjacent unregulated areas) and capable of maintaining a constant, low velocity air flow into regulated areas from adjacent unregulated areas.
27. NESHAPS - National Emissions Standard for Hazardous Air Pollutants regulations enforced by the EPA.
28. Permissible Exposure Level (PEL) - The maximum airborne concentration of asbestos fibers to which an employee is allowed to be exposed. The new level established by OSHA 29 CFR 1926.1101 is 0.1 fibers per cubic centimeter of air as an eight (8) hour time weighted average and 1.0 fibers /cc averaged over a sampling period of 30 minutes as an Excursion Limit. The Contractor is responsible for maintaining work areas in a manner that this standard is not exceeded.
29. Project Monitor - A professional capable of conducting air monitoring and analysis of schemes. This individual should be an industrial hygienist, an environmental scientist, or an engineer with experience in asbestos air monitoring and worker protection equipment and procedures. This individual should have demonstrated proficiency in conducting air sample collection in accordance with 29 CFR 1910.1001 and 29 CFR 1926.1101.
30. Regulated Area - An area established by the employer to demarcate where Class I, II, and III asbestos work is conducted and any adjoining area where debris and waste from such asbestos work accumulate, and a work area within which airborne concentrations of asbestos exceed or there is a reasonable possibility that they may exceed the PEL.
31. Shower Room - A room between the clean room and the equipment room in the work decontamination enclosure with hot and cold running water and suitably arranged for employee showering during decontamination. The shower room is located in an airlock between the contaminated area and the clean area.
32. Waterproofing - material, usually a membrane or applied compound (tar/mastic), used to make a surface impervious to water, includes concealed conditions (applications around doors, windows, and in wall cavities). Sometimes combined with felts.

1.11 SUBMITTALS

A. Pre-Work Submittals: Within 7 days prior to the pre-construction conference, the Contractor shall submit 3 copies of the documents listed below to the Owner and Engineer for review:

1. Valid Contractor's Asbestos Removal license issued by the Connecticut Department of Public Health (CT DPH).
2. Certificate of insurance covering work of this Contract.
3. Name, experience of supervisors, and copies of valid Asbestos Supervisor permits issued by the CT DPH.
4. Citations/Violations/Legal Proceedings: Submit a statement describing:

    a. Any citations, violations, criminal charges, or legal proceedings undertaken or issued within the past two years by any law enforcement, regulatory agency, or consultant concerning performance on previous abatement contracts. Briefly describe the circumstances citing the Project and involved persons and agencies as well as the outcome of any actions.
    b. Any litigation or arbitration proceedings arising out of performance on past Projects.

5. Work Schedule:

    a. Show the complete sequence of abatement activities and the sequencing of work within each building section.
    b. Show the dates for the beginning and completion of each major element of work including substantial completion dates for each work area, building, or phase.
    c. Show projected percentage of completion for each item, as of the first day of each month.

d. Show final inspection dates.

6. Project Notifications: As required by Federal, State, and local regulatory agencies together with proof of transmittal (i.e. certified mail return receipt). The contractor shall notify the Connecticut Department of Public Health and US EPA Region 1 at least ten (10) days prior to the start of asbestos abatement, as required by the Regulations of Connecticut State Agencies, Section 19a-332a-3 and EPA.
7. Abatement Work Plan: The Contractor shall design, prepare and submit to the Authority for review and approval, a detailed asbestos removal plan for the project in accordance with the applicable regulations and these specifications. The plan shall, at minimum, show limits of containment and work areas, methods of removal, location of decontamination units, number and location of negative air units, waste routes, waste storage location, entrance and exits, emergency exits, and any necessary details. Work shall not commence until the Authority has reviewed, commented and approved the contractor's asbestos removal plan. Provide plans which clearly indicate the following:

    a. All Work Areas/containment numbered sequentially.
    b. Locations and types of all decontamination enclosures.
    c. Entrances and exits to the Work Areas/containment.
    d. Type of abatement activity/technique for each Work Area/containment.
    e. Number and location of negative air units and exhaust. Also provide calculations for determining number of negative air pressure units.
    f. Proposed location and construction of storage facilities and field office.
    g. Location of water and electrical connections to building services.
    h. Waste transport routes through the building to the waste storage container.

8. Contingency plan.
9. Name, location, and applicable licenses for primary and secondary landfill for disposal of asbestos-containing material and asbestos contaminated waste.
10. Summary of proposed materials, and equipment to be used.
11. Certification that vacuums, temporary ventilation equipment, and other equipment to be used meet the ANSI 29.2-79 requirement for airborne fiber filtration.
12. If rental equipment is to be used in work area or to transport asbestos contaminated waste, provide notice to rental agency stating intended use of equipment, with copy to the Authority.
13. Summary of the Contractor's workforce by disciplines. Include a notarized statement signed by the Contractor documenting that all proposed workers, by name, have received all required medical examinations and have been properly trained and certified in asbestos removal work, respirator use, to appropriate EPA and OSHA standards for asbestos removal. Include on statement Contractor's compliance with OSHA medical surveillance requirements.
14. The Contractor shall submit his/her Health and Safety Plan and Standard Operating Procedures for this project for use in complying with the requirements of these Specifications and applicable regulations. The Plan shall include, but shall not be limited to: distribution and use of amended water, the sequencing of asbestos work, detailed schedules and dates, shift times, and work activities during that shift, the interface of other trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the Site, security of the work areas, and a detailed description of the methods to be employed to control airborne fiber concentrations.
15. Written description of emergency procedures to be followed in case of injury or fire. This section must also include evacuation procedures, sources of medical assistance and procedures for access by medical personnel.
16. Level of respiratory protection intended for each operation for the project.

B. Project Closeout Submittals: Submit the following to Owner and Consultant at the close out of the Project (no later than 15 days subsequent to site demobilization):

1. Originals of all waste disposal manifests, seals, and disposal logs.
2. OSHA compliance air monitoring records conducted during the work.
3. Daily progress log.

    a. A list of all workers used in the performance of the Project, including name, social security number, and CT DPH certification number.
    b. For each worker used in the performance of the project, submit required employee statements including Medical Examination Statement, Worker's Acknowledgment Statement, Respirator Fit Test, and Employee Training Statement.
    c. Certification for the laboratory that analyzed the OSHA personnel air samples.
    d. A notarized “Release of Liens” in a form acceptable to the owner. Such notarized release of liens shall certify that all sub-contractors, labor suppliers, etc. have been paid their pro rate share of all payments to date for the project, that the contractor has no basis for further claims, and will not make further claims for payment in any account after the first payment is made to him.

1.12 MEDICAL REQUIREMENTS

A. Prior to potential exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1910.1001, and 29 CFR 1926.1101.

1. This examination is not required if adequate records show the employee has been examined as required by 29 CFR 1910.1001, and 29 CFR 1926.1101 within the past year.
2. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos fibers and within thirty (30) calendar days before or after the termination of employment in such occupations.

B. As required by 29 CFR 1910.1001, and 29 CFR 1926.1101 maintain complete and accurate records of employees' medical examinations for a period of thirty (30) years after termination of employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health (NIOSH), authorized representatives of either of them, and an employee’s physician upon the request of the employee or former employee.

C. The Contractor shall furnish the Owner evidence of its firm's medical surveillance program required under 29 CFR 1910.1001, and 29 CFR 1926.1101.

1.13 REGULATIONS AND STANDARDS

Regulatory compliance includes but is not necessarily limited to applicable requirements set forth by:

A. Federal Regulations:

1. 29 CFR 1910 and 1926 – Construction and General Industry Standards
2. 29 CFR 1910.1001, "Asbestos" (OSHA)
3. 29 CFR 1910.1200, "Hazard Communication" (OSHA)
4. 29 CFR 1910.134, "Respiratory Protection" (OSHA)
5. 29 CFR 1910.145, "Specification for Accident Prevention Signs and Tags" (OSHA)
6. 29 CFR 1910.146, “Permit Required Confined Spaces” (OSHA)
7. 29 CFR 1926, "Construction Industry" (OSHA)
8. 29 CFR 1926.1101, "Asbestos, Tremolite, Anthophyllite, and Actinolite" (OSHA)
9. 29 CFR 1926.500 "Guardrails, Handrails and Covers" (OSHA)
10. 40 CFR 61, Subpart A, "General Provisions" (EPA)

11. 40 CFR 61, Subpart M, "National Emission Standards for Hazardous Air Pollutants (NESHAP)" (EPA)
12. 40 CFR 763 Subpart E, “Asbestos in Schools Regulations” (EPA)
13. 49 CFR 171-172, Transportation Standards (DOT)

B. Connecticut Regulations:
State requirements which govern asbestos abatement work and hauling and disposal of asbestos waste materials include but are not necessarily limited to the following:

1. Connecticut Department of Energy and Environmental Protection (Solid Waste Management Regulations).
2. Connecticut Department of Public Health (CT DPH) regulations outlined in Section 19a-332a-1 through 19a-332a-16 “Standards for Asbestos Abatement”
3. CT DPH regulations outlined in Section 20-440-1 through 20-440-9 “Licensure and Training Requirements for Persons Engaged in Asbestos Abatement and Consulting Services”
4. Connecticut Department of Labor (CT DOL)
5. Connecticut Department of Transportation (CT DOT)

C. Local Regulations:
Local agencies which may govern or have certain requirements regarding asbestos abatement work or hauling and disposal of asbestos waste materials include but are not necessarily limited to the following:

1. Building Department
2. Health Department
3. Fire Department

D. Standards and Guidance Documents:

1. American National Standard Institute (ANSI) Z88.2-80, Practices for Respiratory Protection
2. ANSI Z9.2-79, Fundamentals Governing the Design and Operation of Local Exhaust Systems
3. EPA 560/585-024, Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)
4. EPA 530-SW-85-007, Asbestos Waste Management Guidance

1.14 EXEMPTIONS

A. Any deviations from these specifications require the written approval and authorization from the Owner and Consultant.

B. Any modifications from the standard work practices identified in the CT DPH Standards for Asbestos Abatement, Sections 19a-332a-1 to 19a-332a-16 must be requested in writing, and approved in writing from the CT DPH.

1.15 FINAL AIR CLEARANCE

A. Following the completion of the encapsulation phase of the work, the Consultant shall collect final air clearance samples inside the work area per AHERA regulation 40 CFR Part 763 and in compliance with CT DPH regulations. The Owner of the facility shall be responsible for payment of the sampling and analysis of the initial final air clearance samples only. The contractor shall be responsible for payment of all costs associated with the collection and analysis of additional final air clearance samples if the first set of samples fail to satisfy the clearance criteria.

1.16 NOTIFICATIONS, POSTINGS, SUBMITTALS, AND PERMITS

A. The contractor shall make the following notifications, and provide the submittals to the following agencies prior to the commencement of removal work. This notification is required ten (10) calendar days prior to the start of the abatement project:

1. U.S. EPA, Region 1
   5 Post Office Square, Suite 100 (OES05-4)
   Boston, MA 02109-3912

2. Connecticut Department of Public Health
   410 Capital Avenue MS #12 AIR
   P.O. Box 340308
   Hartford, CT 06134

B. The minimum information included in the notification to these agencies includes:

1. Name and address of building Owner/Operator
2. Building location
3. Building size, age, and use
4. Amount of friable asbestos
5. Work schedule, including proposed start and completion date
6. Asbestos removal procedures to be used
7. Name and location of disposal site for generated asbestos waste, residue, and debris
8. If landfill opens in Connecticut to accept ACM waste, Consultant will notify CT DEEP prior to utilizing said landfill.

1.17 WORK SITE SAFETY PLAN

A. The contractor shall establish a set of emergency procedures and shall post them in a conspicuous place at the work site. The safety plan should include provisions for the following:

1. Evacuation of injured workers.
2. Emergency and fire exit routes from all work areas.
3. Emergency first aid treatment
4. Local telephone numbers for emergency services including ambulance, fire, and police.
5. A method to notify occupants of the building in the event of a fire or other emergency requiring evacuation of the building.

B. The contractor is responsible for training all workers in these procedures.

1.18 INDEPENDENT AIR SAMPLING AND ASBESTOS ABATEMENT MONITORING

A. This section describes independent air sampling work being performed on behalf of the Owner. This work is not in the Contract Sum. This section describes air monitoring carried out by the Owner's Consultant to verify that the building beyond the work area and the outside environment remains uncontaminated. (Personal air monitoring required by OSHA is work to be performed by the Contractor and is within the Contract Sum.)

B. The purpose of the Owner's Consultant's air monitoring is to detect faults in the work are isolation such as:

1. Contamination of the building outside of the work area by airborne asbestos fibers.
2. Failure of filtration or rupture in the differential pressure system.
3. Contamination of air outside the building envelope by airborne asbestos fibers.

Should any of the above occur the Contractor shall immediately cease asbestos abatement activities until the fault is corrected. Do not recommence work until authorized by the Owner's Consultant.

C. The Owner's Consultant will monitor airborne fiber counts in the Work Area. The purpose of this air monitoring will be to detect airborne asbestos concentrations, which may challenge the ability of the Work Area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.

D. To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to an acceptable level, the Consultant will sample and analyze air in accordance with clearance air sampling requirements.

E. The Owner's Consultant will perform on-site monitoring throughout the course of the project, as follows:

1. All work procedures shall be continuously monitored by the Consultant to assure that areas outside the designated work locations in the buildings will not be contaminated.
2. Prior to work on any given day, the Contractor's designated "competent person" shall discuss the day's work schedule with the Consultant to evaluate job tasks with respect to safety procedures and requirements specified to prevent contamination of the building or the employees. This includes a visual survey of the work area and the decontamination of the building or the employees. This includes a visual survey of the work area and the decontamination enclosure systems.

1.19 CONTRACTOR’S AIR SAMPLING RESPONSIBILITY

A. The contractor shall independently retain a CT licensed asbestos project monitor to monitor airborne asbestos concentrations in the workers' breathing zone and to establish conditions and work procedures for maintaining compliance with OSHA Regulations 29 CFR 1910.1001 and 1926.1101.

B. The Contractor's project monitor shall document all air sampling results and provide a report to the Consultant within 24 hours after sample collection.

C. All air sampling shall be conducted in accordance with methods described in OSHA Standards 29 CFR 1910.1001 and 1926.1101 and the OSHA Respiratory Protection Standard 29 CFR 1910.134.

D. A minimum of 20% of all workers in each working category (i.e., gross removal, final clearance, etc.) must be monitored each day of asbestos removal activities.

E. Phase Contrast Microscopy may be used to analyze personal air samples. The Contractor shall arrange and pay for all costs of the testing. Laboratories used shall be currently enrolled in the American Industrial Hygiene Association Proficiency Analytical Testing Program or an equivalent recognized program and approved by CT DPH.

1.20 PROPER WORKER PROTECTION

A. This section describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

B. All workers are to be accredited as abatement workers as required by the AHERA regulation 40 CFR 763 Appendix C to Subpart E, February 3, 1994.

C. The contractor is required to be certified and accredited as required by the State of Connecticut Department of Public Health Services.

D. In accordance with 29 CFR 1926 and 20-440-7 RCSA, all workers shall receive a training course covering the dangers inherent in handling asbestos, the dangers of breathing asbestos dust, proper work procedures, and proper worker protective measures. This course must include but is not limited to the following:

1. Methods of recognizing asbestos
2. Health effects associated with asbestos
3. Relationship between smoking and asbestos in producing lung cancer
4. Nature of operations that could result in exposure to asbestos
5. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

    a. Engineering controls
    b. Work Practices
    c. Respirators
    d. Housekeeping procedures
    e. Hygiene facilities
    f. Protective clothing
    g. Decontamination procedures
    h. Emergency procedures

6. Waste disposal procedures
7. Purpose, proper use, fitting, instructions, and limitations of respirators as required by 29 CFR 1910.134
8. Appropriate work practices for the work
9. Requirements of medical surveillance program
10. Review of 29 CFR 1926
11. Pressure Differential Systems
12. Work practices including hands on or on-job training
13. Personal Decontamination procedures
14. Air monitoring, personal and area

E. The Contractor shall provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8-hour Time Weighted Average and/or enter regulated areas. In the absence of specific airborne fiber data provide medical examinations for all workers who will enter the Work Area for any reason. Examination shall, at a minimum, meet OSHA requirements as set forth in 29 CFR 1926 In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.

F. Submit the following to the consultant for review. The contractor shall not start work until these submittals are returned with consultant action stamp indicating that they are approved.

1. Submit copies of certificates from an EPA-approved AHERA abatement workers course for each worker as evidence that each asbestos abatement worker is accredited as required by the AHERA Regulation 40 CFR 763 Appendix C to Subpart E, February 3, 1994.
2. Submit evidence that the contractor is certified to perform asbestos abatement work by the State of Connecticut Department of Public Health services.
3. Submit documents verifying that each worker has had a medical examination within the last 12 months as part of compliance with OSHA medical surveillance requirements. Submit, at a minimum, for each worker the following:

a. Name and Social Security Number
b. Physicians Written Opinion from examining physician including at a minimum the following:

4. Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to asbestos.
5. Any recommended limitations on the worker or on the use of personal protective equipment such as respirators.
6. Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.
7. Copy of information that was provided to physician in compliance with 29 CFR 1926
8. Statement that worker is able to wear and use the type of respiratory protection proposed for the project, and is able to work safely in an environment capable of producing heat stress in the worker.
9. Submit copies of certificates for the site supervisor and the workers issued by CT DPH.

G. Submit certification signed by an officer of the abatement-contracting firm and notarized that exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.

H. The Contractor shall maintain control of and be responsible for access to all work areas to ensure the following requirements:

1. Non-essential personnel are prohibited from entering the area.
2. All authorized personnel entering the work area shall read the "Worker Protection Procedures" which are posted at the entry points to the enclosure system, and shall be equipped with properly fitted respirators and protective clothing.
3. All personnel who are exiting from the decontamination enclosure system shall be properly decontaminated.
4. Asbestos waste that is taken out of the work area must be properly bagged and labeled in accordance with these specifications. The surface of the bags shall be decontaminated. Asbestos leaving the enclosure system must be immediately transported off-site or immediately placed in locked, posted temporary storage on-site, and removed within 24 hours of the project conclusion.
5. Any material, equipment, or supplies that are brought out of the decontamination enclosure system shall be cleaned and decontaminated by wet cleaning and/or HEPA vacuuming of all surfaces.

1.21 ALTERNATE WORK PRACTICES

A. The contractor and/or consultant may obtain services of a CT DPH certified asbestos project designer and submit application for variances to the CT DPH, as applicable for any alterations, modifications or non-conforming methods intended of asbestos removal. Methods requiring variances include but are not necessarily limited to glove-bagging, use of tent procedures, remote decons, etc. The alternative procedures shall be submitted in writing and hand delivered or post marked at least ten (10) days before the project start date. CT DPH may approve an alternative procedure for an asbestos abatement project with certain conditions that would provide equivalent or a greater measure of asbestos emission control than the conventional work practices. The alternate work practice request form shall be signed and sealed by a Licensed Designer. Any fees associated with the application shall be paid by the Contractor. All alternative work practices (AWPs) must be approved and accepted by Langan’s project designer regardless if they have been approved by CT DPH. The abatement contractor will be required to propose a credit to the building owner/client/consultant that must be reviewed and accepted prior to AWP submission to CT DPH.

1.22 POST-PROJECT CLOSEOUT

A. The contractor shall provide all required documentation as required by this specification once his/her work is complete, final clearances passed and asbestos waste disposed of. This should include but not be limited to: bound copy of the daily log containing log of daily work activities, all supervisor and worker certificates of training and Connecticut licenses, certificates of insurance, daily sign in sheets, containment entry/exit logs, copy of recording manometer charts, waste shipment records, personal air monitoring laboratory reports and chain-of-custody documentation, and project completion certificate. Final payment shall not be made to the contractor until all required documentation is submitted and verified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name and product technical description.

B. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes contaminated with asbestos shall be decontaminated or disposed of as asbestos waste.

C. Polyethylene sheet in a roll size to minimize the frequency of joints shall be delivered to the job site with factory label indicating 4 or 6 mil.

D. Polyethylene disposable bags shall be six (6) mil with pertinent pre-printed label. Tie wraps for bags shall be plastic, five (5) inches long (minimum), pointed and looped to secure filled plastic bags.

E. Tape or adhesive spray will be capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.

F. Surfactant (wetting agent), shall consist of fifty (50) percent polyoxyethylene ether and fifty (50) percent polyoxyethylene ester, or equivalent, and shall be mixed with water to provide a concentration of one (1) ounce surfactant to five (5) gallons of water or as directed by manufacturer.

G. Removal encapsulant shall be non-flammable factory prepared penetrating chemical encapsulant found acceptable to Consultant. Usage shall be in accordance with manufacturer's printed technical data.

H. The contractor shall have available spray equipment capable of mixing wetting agent with water and capable of generating sufficient pressure and volume and having sufficient hose length to reach all areas with asbestos.

I. Impermeable containers are to be used to received and retain any asbestos-containing or contaminated materials until disposal at an acceptable disposal site. The containers shall be labeled in accordance with OSHA Standard 29 CFR 1926.1101. Containers must be both air and watertight.

J. Labels and signs, as required by OSHA Standard 29 CFR 1926.1101, will be used.

K. Encapsulant shall be bridging or penetrating type which has been found acceptable to the consultant. Usage shall be in accordance with manufacturer's printed technical data.

L. HEPA filtered local exhaust ventilation shall be utilized during the installation of enclosures and supports where asbestos-containing materials may be disturbed.

2.2 TOOLS AND EQUIPMENT

A. The contractor shall provide all tools and equipment necessary for asbestos removal, encapsulation and enclosure.

B. The contractor's air monitoring professional shall have air-monitoring equipment of type and quantity to monitor operations and conduct personnel exposure surveillance per OSHA requirements.

C. The contractor shall have available sufficient inventory or dated purchase orders for materials necessary for the job including protective clothing, respirators, filter cartridges, polyethylene sheeting of proper size and thickness, tape and air filters.

D. The contractor shall provide (as needed) temporary electrical power panels, electrical power cables, and electrical power sources (such as generators). Any electrical connection work affecting the building electrical power system shall be performed by a State of Connecticut licensed electrician and the contractor shall obtain all necessary local permits.

E. The contractor shall have available shower stalls and plumbing to support same to include sufficient hose length and drain system or an acceptable alternate.

F. Exhaust air filtration system units shall contain HEPA filter(s) capable of sufficient air exhaust to create negative pressure of -0.02 inches of water within enclosure with respect to outside area. Equipment shall be checked for proper operation by smoke tubes or differential pressure gauge before the start of each shift and at least twice during the shift. Adequate exhaust air shall be provided for a minimum of four (4) air changes per hour within the enclosure. No air movement system or air filtering equipment shall discharge unfiltered air outside.

G. Vacuum units, of suitable size and capacities for the project, shall have HEPA filter(s) capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.

H. The contractor will have reserve units so that systems will operate continuously.

2.3 RESPIRATORY PROTECTION

A. Select respirators from those approved by the Mine Safety and Health Administration (MSHA), and the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

B. Respirators shall be individually fit-tested to personnel under the direction of an Industrial Hygienist on a yearly basis. Fit-tested respirators shall be permanently marked to identify the individual fitted, and use shall be limited to that individual. Fit-test records shall be maintained on-site for each employee.

C. Where fiber levels permit, and in compliance with regulatory requirements, Powered Air Purifying Respirators (PAPR) are the minimum allowable respiratory protection permitted to be utilized during gross removal operations. The Contractor shall use supplied air respirator for confined

space requirements. PAPR's are the minimal respiratory protection required for all thermal system insulation and surfacing asbestos abatement.

D. No respirators shall be issued to personnel without such personnel participating in a respirator training program.

E. High Efficiency Particulate Air (HEPA) respirator filters shall be approved by NIOSH and shall conform to the OSHA requirements in 29 CFR 1910.134 and 29 CFR 1926.1101.

F. A storage area for respirators shall be provided by the contractor in the clean room side of the personnel decontamination enclosure where they will be kept in a clean environment.

G. The contractor shall provide and make available a sufficient quantity of respirator filters so that filter changes can be made as necessary during the work day. Filters will be removed and discarded during the decontamination process. Filters cannot be reused. Filters must be changed if breathing becomes difficult.

H. Filters used with negative pressure air purifying respirators shall not be used any longer than one eight (8) hour work day.

I. Any authorized visitor, worker, or supervisor found in the work area not wearing the required respiratory protection shall be removed from the project site and not be permitted to return.

J. The contractor shall have at least two (2) Powered Air Purifying Respirators stored on-site designated for authorized visitors use. Appropriate respirator filters for authorized visitors shall be made available by the contractor.

K. Establish a respirator program as required by ANSI Z88.2 and 29 CFR 1910.134, and 29 CFR 1926.1101. Provide respirator training and fit-testing.

2.4 PROTECTIVE CLOTHING

A. Provide personnel utilized during the Project with disposable protective whole body clothing, head coverings, gloves and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may also be worn. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape, or provide disposable coverings with elastic wrists or tops.

B. Provide sufficient quantities of protective clothing to assure a minimum of four (4) complete disposable outfits per day for each individual performing abatement Work.

C. Eye protection and hard hats shall be provided and made available for all personnel entering any work area.

D. Authorized visitors shall be provided with suitable protective clothing, headgear, eye protection, and footwear whenever they enter the work area.

PART 3 - EXECUTION

3.1 PRE-ABATEMENT MEETING

A. At least one week prior to the start of work a Pre-Construction Meeting will be scheduled and must be attended by the contractor and any sub-contractors. The assigned contractor site supervisor is also required to attend this meeting.

B. The contractor shall present a detailed project schedule and project submittals at the Pre-Construction Meeting. Variations, amendments, and corrections to the presented schedule will be discussed, and the Owner and consultant will inform the contractor of any scheduling adjustments for this project.

C. Following the Pre-Construction Meeting, the contractor shall submit a revised schedule (if needed) no later than one week after the meeting.

3.2 WORK AREA PREPARATION

A. Where necessary, shut down electrical power, including receptacles and light fixtures. Under no circumstances during the decontamination procedures will lighting fixtures be permitted to be operating when the spraying of amended water may contact the fixture. Provide GFCI devices, temporary power, and temporary lighting installed in compliance with the applicable electrical codes. All installations are to be made by a State of Connecticut licensed electrician.

B. Shut down and/or isolate heating, cooling, and ventilation air systems or zones to prevent contamination and fiber dispersal to other areas of the structure. During the work, vents within the work area shall be "criticalled" with duct tape and polyethylene sheeting.

C. The contractor shall be responsible for removing furniture from the work areas. The contractor shall pre-clean moveable objects within the proposed work areas using HEPA vacuum equipment and/or wet cleaning methods as appropriate and remove such objects from work areas to a temporary location. For example, cabinets to gain access to floor tile and associated mastic.

D. Seal off all openings, including, but not limited to, windows, corridors, doorways, skylights, ducts, grills, diffusers, and any other penetration of the work areas, with polyethylene sheeting a minimum of six (6) mils thick, sealed with duct tape. This includes doorways and corridors that will not be used for passage during work areas and occupied areas.

E. Pre-clean fixed objects within the work areas, using HEPA vacuum equipment and/or wet cleaning methods as appropriate, and enclose with a minimum six (6) mil plastic sheeting sealed with duct tape.

F. Clean the proposed work areas using HEPA vacuum equipment or wet cleaning methods as appropriate. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters.

G. After HEPA vacuum cleaning, cover fixed walls with two (2) layers of four (4) mil polyethylene sheeting to the floor level. Where fixed walls are not used, two layers of six (6) mil polyethylene sheeting will be applied to a rigid framework of wood, metal, or PVC. Where floor tile/mastic is not being abated, cover the floor with two (2) layers of six-mil polyethylene sheeting. All overlaps shall be sealed with tape or spray adhesive.

H. Maintain emergency and fire exits from the work areas, or establish alternate exits satisfactory to fire officials.

I. Clean and remove ceiling mounted objects, such as lights and other items not sealed off, which interfere with asbestos abatement. Use hand-held amended water spraying or HEPA vacuuming equipment during fixture removal to reduce settled fiber dispersal.

J. Create pressure differential between work areas and uncontaminated areas by the use of acceptable negative air pressure equipment sufficient to provide four (4) air changes per hour and create negative pressure of -0.02 inches of water within enclosure with respect to outside area as measured on a water gauge.

3.3 DECONTAMINATION SYSTEM

A. The following requirements shall be followed for the worker decontamination unit:

1. At all asbestos abatement projects, work areas shall be equipped with decontamination facilities consisting of: a clean room, a shower room, and an equipment room attached to each containment.
2. The decontamination enclosure system chambers shall be constructed to meet the criteria of the Specification. The decontamination enclosure shall be installed watertight to prevent water leaks. The interior shall be lined with two layers of 6-mil fire-retardant plastic sheeting, with a minimum overlap of 16 inches at seams and sealed (airtight) by tape and adhesive. The interior floor shall be sheathed with (2) layers of reinforced fire retardant plastic sheeting with a minimum overlap on the wall of sixteen (16) inches. The contractor shall ensure compliance with local building codes and other regulations governing temporary structures.
3. Curtained Doorways: Three overlapping sheets of 6-mil polyethylene shall be placed over a framed doorway and secured along the top of the doorway. Secure the vertical edge of the outer sheets along one vertical side of the doorway and the vertical edge of the center sheet along the opposite vertical side of the doorway. The sheets shall be weighted so that they close quickly after being released.
4. Air Locks: Air locks shall consist of two curtained doorways placed a minimum of three feet apart.

    a. Clean Room: In this room, persons remove and leave all street clothes and put on clean disposable coveralls. Approved respiratory protection equipment is stored in this area. The floor of the clean room must be kept dry at all times. At the end of each shift, the room must be cleaned using wet rags. Also, a lockable door may be installed. No asbestos-containing materials are allowed in this room. The clean room shall be equipped with suitable hooks, lockers, shelves, etc. for workers to store personal articles and clothing. THIS IS NOT A CONTAMINATED AREA.
    b. Shower Room: Provide a completely watertight operational shower to be used by cleanly dressed workers heading for the Work area from the clean room or for showering workers headed out of the Work Area after dressing in the Equipment Room. Shower must be constructed so that water leakage is minimized. The shower shall have one shower per six full shift abatement people, calculated on the basis of the largest shift. Any leaking water must be cleaned immediately. Showers must be equipped with hot and cold running water, soap and sufficient disposable towels for the number of workers at the job site. Arrange water shut off and drain pump operation controls, so that a single individual can shower without assistance from either inside or outside the work area. THIS IS A CONTAMINATED AREA.

        Pump wastewater into a polyethylene lined 55-gallon drum located in the work area to be added to the asbestos waste. If the water is allowed by the work treatment workers to be pumped into a drain, provide 20 micron and 5 micron waste water filters in line to drain. Change filters at a minimum of once a day. Locate filters inside the shower unit, so that the shower pan catches the water lost during filter change.
    c. Equipment Room: Work equipment, footwear, and all other contaminated work clothing are to be left here upon exiting work area. A walk-off pan filled with water shall be located in the work area just outside the equipment room for workers to clean foot coverings while exiting the work area. This is a change and transit area for workers. Provide a drop cloth layer of sheet plastic on the floor of the Equipment Room for every shift change. Roll drop cloth layer in upon itself at the end of each shift and dispose of as contaminated waste. THIS IS A CONTAMINATED AREA.

        Each room shall be separated from the other and from the work area by airlocks such as will prevent the free passage of air or asbestos fibers and shall be accessible through doorways protected with three (3) overlapping 6 mil polyethylene sheets

which shall be weighed, so as to fall into place when people pass through the area. The shower room shall be contiguous to the clean room and equipment room. All personnel entering or leaving the work area shall pass through the shower room. The number of showers provided shall satisfy the requirements of OSHA 29 CFR 1910.141. Hot and cold water shall be supplied to the showers. The equipment room (dirty room) shall be situated between the shower room and the work area and separated from both by means of suitable barriers or overlapping flaps such as will prevent the free passage of air or asbestos fibers.

Decontamination chamber doors shall be of sufficient height and width to enable replacement of equipment, which may fall, and to safely stretcher or carry an injured worker from the site without destruction of the chamber or unnecessary risk to the integrity of the work area. Such doors must be at least four (4) feet wide, and the distance between sets of doors must be at least four (4) feet.

5. No person or equipment shall leave the asbestos abatement project work area unless first decontaminated by showering, wet washing or HEPA vacuuming to remove all asbestos debris. No asbestos contaminated materials or persons shall enter the clean room.
6. Where feasible, decontamination systems shall abut the work area. In situations where it is not possible, due to unusual conditions, to establish decontamination systems contiguous to the work area, personnel shall be directed to remove visible asbestos debris from their persons by HEPA-filtered vacuuming prior to donning clean disposable coveralls while still in the work area, and proceeding directly to a remote decontamination system to shower and change clothes to follow work area exit procedures.
7. In specific situations where the asbestos contractor determines that it is not feasible to establish a contiguous decontamination system at a work site, the asbestos contractor shall utilize a remote decontamination system if approved by Langan. Such systems must be operated in conformance with 29 CFR 1926.1101, Appendix F.

B. Remote Decontamination Facility:

For exterior work on the roof, glove bag or tent procedures, when full containment enclosure is not feasible, the Contractor shall provide remote personnel decontamination enclosure system if approved by the Consultant - Langan.

C. Occupied areas and/or building space not within the work areas shall be separated from asbestos abatement work areas by means of airtight barriers.

D. Construct the decontamination system with wood or metal framing, 3/8" sheathing and cover both sides with a double layer of six (6) mil polyethylene sheeting, spray glued or taped at the joints. Caulk joints watertight at floor, walls, and ceiling.

E. The contractor and the consultant shall visually inspect barrier several times daily to assure effective seal and the contractor shall repair defects immediately

F. Waste/Equipment Decontamination Enclosure System:
This system is located adjacent to the work area. The equipment decontamination enclosure system, consisting of two totally enclosed spaces, shall be constructed as follows:

1. Equipment Washroom: An equipment washroom shall have two air locks: one adjacent to the work area and one common air lock which separate it from the holding area. The washroom shall have facilities for washing material containers and equipment. Gross removal of dust and debris from contaminated material containers and equipment shall be accomplished in the work area, prior to moving to the washroom.
2. Holding Area: A holding area shall share a common air lock with the equipment washroom and shall have a curtained doorway to outside areas. A hinged, lockable door

shall be placed at the holding area entrance to prevent unauthorized access into the work area.

3. Remote Decontamination Facility: For exterior work on the roof, glove bag or tent procedures, when full containment enclosure is not required, the contractor shall provide remote Waste/Equipment decontamination enclosure system as specified.

3.4 ABATEMENT REMOVAL PROCEDURES

A. Regulatory compliance will include, but is not necessarily limited to, applicable requirements set forth by the Federal Environmental Protection Agency (EPA), Connecticut Departments of Public Health (CT DPH), Connecticut Department of Environmental Protection, and Greenwich/local Health and Building Departments.

B. The following procedures shall be followed while performing the abatement activities:

1. No asbestos abatement work, including preparation, shall be performed or continued without having proper notification and a certified supervisor at the work area. The contractor shall have a designated "competent person" on the job at all times to ensure establishment of a proper enclosure system and proper work practices throughout the project.
2. Abatement work will not commence until authorized by the consultant.
3. Provide and display danger signs at every entrance to the work areas in clearly visible locations indicating that asbestos removal work is being conducted and unauthorized and not protected persons should not enter.
   Signs must use the following legend:

   DANGER
   ASBESTOS
   MAY CAUSE CANCER
   CAUSES DAMAGE TO LUNGS
   AUTHORIZED PERSONNEL ONLY
   WEAR RESPIRATORY PROTECTION AND
   PROTECTIVE CLOTHING IN THIS AREA

   Signs shall be posted which meet the specifications set forth in 29 CFR 1926.1101 at all approaches to the work area. Signs shall be posted a sufficient distance from the work area to permit a person to read the sign and take precautionary measures to avoid exposure to asbestos.

4. The worker decontamination enclosure system shall be installed or constructed prior to plasticizing the work area or before disturbing ACM. The waste decontamination enclosure system shall be installed or constructed prior to commencement of gross removal work.
5. All asbestos handlers shall wear disposable suits, including gloves, hood and footwear, and appropriate respiratory equipment, after removing street clothes in the clean room.
6. Abatement of asbestos-containing materials shall be done by wet methods only.
7. ACM shall be sprayed with amended water in sufficient frequency and quantity for enhanced penetration. Sufficient time shall be allowed for penetration to occur prior to removal action or other disturbance-taking place. Dry removal of asbestos materials is prohibited.
8. In order to maintain indoor asbestos concentrations to the minimum, the wet asbestos must be removed in manageable sections. Material drop shall not exceed eight (8) feet. For heights up to 15 feet, provide inclined chutes or scaffolding to intercept drop.
9. Remove asbestos containing materials as appropriate by standard methods. Fill disposal containers as removal proceeds; seal filled containers and clean containers before removal to equipment decontamination system. Wet clean each container

thoroughly, double bag and apply caution label. Ensure that workers do not exit the work area thorough the equipment decontamination enclosure.

10. After completion of stripping work, all surfaces from which asbestos has been removed shall be wet brushed, using a nylon brush, wet wiped, and sponged or cleaned by an equivalent method to remove all visible material (wire brushes are not permitted). During this work, the surfaces being cleaned shall be kept wet.
11. Remove and containerize all visible accumulations of asbestos-containing and/or asbestos-contaminated debris. During cleanup, utilize brooms, rubber dustpan, and rubber squeegees to minimize damage to floor covering.
12. Retrieve all free water in contaminated areas and place in plastic lined leak-tight drums.
13. Sealed disposal containers, and all equipment used in the work area, shall be included in the cleanup and shall be removed from work areas via the equipment decontamination enclosure at an appropriate time in the cleaning sequence. All asbestos waste in 6-mil polyethylene disposal bags shall be double bagged in the equipment decontamination enclosure before removal from the Site.
14. At any time during asbestos removal, should the consultant suspect contamination of areas outside the work area(s), he shall cause all abatement work to stop until the contractor takes steps to decontaminate these areas and eliminate the causes of such contamination. Unprotected individuals shall be prohibited from entering suspected contaminated areas until air sampling and visual inspections certify decontamination.
15. After completion of the initial final cleaning procedure including removal of the inner layers of polyethylene sheeting, but prior to encapsulation, a pre-sealant inspection shall be conducted by the consultant. The pre-sealant inspection shall verify that ACM and residual dust has been removed from the work area.
16. After the work area has been inspected by the Engineer and rendered free of visible debris, a thin coat of a pigmented (non-transparent) encapsulating agent shall be applied to all surfaces in the work area from which ACM was removed, to lockdown nonvisible fibers.
17. Removal of asbestos containing materials shall be done under negative pressure containment. All OSHA Class I, Class III, and interior Class II asbestos abatement projects shall employ HEPA negative air pressure equipment ventilation. The negative air pressure equipment shall operate continuously, twenty-four (24) hours a day, from startup of negative air pressure equipment, through the cleanup operations. A negative air pressure, relative to areas outside of the enclosure, shall be maintained at all times in the regulated abatement work area during the asbestos abatement project to ensure that contaminated air in the regulated abatement work area does not escape back to an uncontaminated area. A manometer shall be used to document the pressure differential for all OSHA Class I Large and Small size asbestos project regulated abatement work areas. A minimum of -0.02 column inches of water pressure differential, relative to pressure outside the regulated abatement work area, shall be maintained within the regulated abatement work area, as evidenced by manometric measurements.

3.5 CONSULTANT

A. The Owner has retained Langan Engineering (Langan) as the Hazardous Materials Consultant for the purpose of project design, construction administration, and project monitoring during Asbestos Abatement. Mr. Matthew Myers (License #000058) of Langan is the DPH-approved Asbestos Project Designer for this project. The Consultant will represent the Owner in all tasks of the abatement project at the discretion of the Owner. The Asbestos Abatement Contractor will regard the Consultant's direction as authoritative and binding as provided herein, in matters particularly but not limited to approval of work areas, review of monitoring results, completion of the various segments of work, final completion of the abatement, submission of data, and daily field punch list items.

3.6 CONSULTANT'S RESPONSIBILITIES

A. Air sampling shall be conducted by the consultant to ascertain the integrity of controls that protect the building from asbestos contamination. Independently, the contractor shall monitor air quality within the work area to ascertain the protection of employees and to comply with OSHA regulations.

B. The consultant's CT DPH licensed asbestos project monitor shall collect and analyze air samples during two time periods:

1. Abatement Period: If required, the consultant's project monitor shall collect samples on a daily basis during the work period. A sufficient number of area samples shall be taken outside of the work area, at the exhaust of the negative pressure system, and outside of the building to judge the degree of cleanliness or contamination of the building during removal. Additional samples may be taken inside the work area and decontamination enclosure system, at the discretion of the project monitor.
2. Post-Abatement Period: The consultant's project monitor shall conduct air sampling following the final cleanup phase of the project, once the "no visible residue" criterion, as established by the project monitor, has been met. Five (5) samples shall be collected inside the work area utilizing aggressive methods to comply with the State of Connecticut Department of Public Health Standards for Asbestos Abatement, sections 19a-332a-12. Analysis of the samples to determine airborne concentrations of asbestos shall be conducted by Transmission Electron Microscopy (TEM) method with an average limit of 70.0 structures per square millimeter of filter surface or by Phase Contrast Microscopy (PCM) with a limit of 0.010 fibers per cubic centimeters of air in accordance with the above Connecticut regulation sections.

C. The consultant's project monitor shall provide continual evaluation of the air quality of the building during removal, using his/her best professional judgment in respect to the State of Connecticut Department of Public Health guideline of 0.010 fibers/cc and the background air quality established during the pre-abatement period.

D. If the project monitor determines that the building air quality has become contaminated from the project, he/she shall immediately inform the contractor to cease all removal operations and implement a work stoppage clean up procedure. The contractor shall conduct a thorough cleanup of the areas of the building designated by the consultant. No further removal work can take place until the project monitor has assessed that the building air has been decontaminated.

E. Pre-abatement and abatement air samples shall be collected as required to obtain a volume of 1,200 liters. Samples shall be analyzed by Phase Contrast Microscopy (PCM) methodology using the NIOSH 7400 protocol.

3.7 CONSULTANT'S INSPECTION RESPONSIBILITIES

A. The consultant shall conduct inspection throughout the progress of the abatement project. Inspections shall be conducted in order to document the progress of the abatement work as well as the procedures and practices employed by the abatement contractor.

B. The consultant shall perform the following inspections during the course of abatement activities:

1. Pre-commencement Inspection: Pre-commencement inspections shall be performed at the time requested by the abatement contractor. The consultant shall be informed 12 hours prior to the time the inspection is needed. If, during the course of the pre-commencement inspection, deficiencies are found, the contractor shall perform the necessary adjustments in order to obtain compliance.

2. Work Area Inspections: Work area inspections shall be conducted on a daily basis at the discretion of the consultant. During the course of the work inspections, the consultant shall observe the contractor's removal procedures, verify barrier integrity, monitor negative air filtration devices, assess project progress, and inform the abatement contractor of specific remedial activities if deficiencies are noted.
3. Pre-encapsulation/Final Visual Inspection: The consultant, upon the request of the abatement Contractor, shall conduct a pre-sealant inspection. The consultant shall be informed 24 hours prior the time that the inspection is needed. The pre-encapsulation inspection shall be conducted after completion of the all cleaning procedures, but prior to encapsulation. The pre-encapsulation inspection shall verify that all ACM and residual debris have been removed from the work area. If, during the course of the pre-encapsulation inspection, the consultant identifies residual dust or debris, the contractor shall comply with the request of the consultant in order to render the area "dust free."

3.8 CLEARANCE AIR TESTING

A. After the visual inspection is completed and all surfaces in the abatement area have dried, final air clearance sampling shall be performed by the consultant. Aggressive air monitoring will be used. Selection of location and samples shall be the responsibility of the consultant. Air monitoring volumes shall be sufficient to provide a detection limit of 0.010 f/cc using NIOSH-approved method for PCM analysis. For air clearance by Transmission Electron Microscopy, air-monitoring volumes shall be sufficient to provide a detection limit of 0.005 f/cc using the AHERA Level II Yamate Method.

B. Areas which do not comply with the Standard for Cleaning for Initial Clearance shall continue to be cleaned by and at the contractor's expense until the specified Standard of Cleaning is achieved as evidenced by results of air testing as previously specified.

3.9 ASBESTOS WASTE DISPOSAL

A. The contractor shall package, label, and remove all asbestos waste from the work area in accordance with Connecticut DEEP and DPH regulations, all other applicable regulations, and as specified below. Packaging shall be accomplished in a manner that minimizes waste volume, but insures waste containers shall not tear or break. All waste shall be transported in leak tight containers.

B. Asbestos wastes may include building materials, insulation, disposable clothing and protective equipment, plastic sheeting and tape, exhaust systems or vacuum filters, contractor equipment, or other materials designated by state or local authorities which have been potentially contaminated with asbestos and have not been fully cleaned.

C. Waste Labeling

1. Warning labels, having waterproof print and permanent adhesive in compliance with OSHA, EPA, CT DEEP/DOT and CT DPH requirements, shall be affixed to or printed on the sides of all waste bags or transfer containers. Warning labels shall be conspicuous and legible, and contain the following words:

   DANGER
   CONTAINS ASBESTOS FIBERS
   MAY CAUSE CANCER
   CAUSES DAMAGE TO LUNGS
   DO NOT BREATHE DUST
   AVOID CREATING DUST

2. In compliance with NESHAP, 40 CFR, Part 61.150, all waste containers or bags shall be labeled with the following generator information:

    a. Name of waste generator
    b. Location of where waste was generated

D. Wetting of Waste: A fine water spray shall be used to keep the top layers of waste in containers thoroughly wet at all times. When a waste bag is full, air within the bags shall be evacuated with a HEPA equipped vacuum and be securely sealed with tape or other secure fastener.

E. Use and Decontamination of Fiber Drums: The Contractor's use and decontamination of fiber drums shall be in accordance with CT DPH, EPA and DOT requirements. The drums shall be lined with a minimum of two layers of 6-mil asbestos waste bags. The waste will be appropriately labeled and sealed. The drums shall be sealed with an airtight lid and shall be decontaminated and/or additionally bagged if the drums are filled inside the containment and visible debris/contamination is observed on the exterior of the drums. All waste shall be labeled as previously described. The drums and waste will be re-containerized should their integrity be compromised and/or liquid is visibly passing through or staining the container.

F. Waste Container Storage: The container used for the storage of bagged contaminated waste shall be an enclosed dumpster. The dumpster shall have a solid metal roof and a solid metal door with padlock. At a minimum, line the cargo area with two layers of a 6-mil polyethylene sheeting to prevent contamination from damaged or leaking containers. Floor sheeting shall be installed first and shall extend up the sidewalls 24 inches minimum. Wall sheeting shall be overlapped and taped securely into place. No un-bagged contaminated waste or non-asbestos waste shall be stored in these dumpsters. Ensure that bags placed in dumpsters are undamaged. Warning signs shall be posted on the dumpster in accordance with Sections 29 CFR 1926.1101 of the OSHA regulations.

G. Waste Removal Scheduling: All waste containers shall be decontaminated and removed from the Site before final cleanup is started and isolation barriers are taken down.

H. Waste Transportation and Disposal

1. It is the responsibility of the contractor to determine and insure that the contractor and his/her subcontractor are complying with: 1) current waste handling regulations; and 2) the current regulations for transporting and disposing waste at the ultimate disposal landfill. The contractor must comply fully with these regulations, and with all U.S. Department of Transportation, State, local, and EPA requirements.
2. The contractor's waste hauler and disposal contractor shall maintain a valid hazardous waste transporter's permit and identification number; and obtain complete, and fully comply with any other local hazardous waste manifesting requirements.
3. Exercise care before and during transport to ensure that no unauthorized persons have access to the containerized ACW.
4. Do not transport ACW on open trucks. Treat and dispose of drums that have been contaminated as asbestos-containing waste.
5. A copy of ACW manifest forms shall be sent to the Owner after each disposal is completed and all required data and signatures have been inserted.
6. The contractor shall return the original Disposal Certificate (landfill receipt) to the Owner within 10 working days of waste shipment from the Site.

END OF SECTION 028213

SECTION 028313 – LEAD-BASED PAINT AWARENESS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Refer to all drawings and/or other Sections of these specifications to determine the type and extent of work therein affecting the work of this Section, whether or not such work is specifically mentioned herein.

C. Sections containing requirements related to this Section include, but are not limited to:

1. Section 028200 – Selective Hazardous Building Materials Abatement Demolition
2. Section 028213 – Asbestos Abatement
3. Section 028416 – Universal Waste Removal and Recycling
4. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 SUMMARY OF WORK

A. Work of this Section includes requirements for worker protection and waste disposal related to the renovation work involving components and surfaces containing lead at the Eastern Middle School project site located in Greenwich, Connecticut. All materials should be considered to contain some amounts of lead. XRF screening identified lead-based paint on the interior stairwell metal handrails, guardrails, baseboard and sideboards. The contractor must follow lead-safe work.

B. The procedures referenced herein shall be utilized during required demolition work specified elsewhere in the Architect's Specification that might impact lead.

C. Renovation and demolition activities may result in dust and debris exposing workers to levels of lead above the OSHA Action Level. Worker protection, training, and engineering controls referenced herein shall be strictly adhered to, until completion of exposure assessment with results indicating exposures below the "Action Level". This section does not involve lead abatement by CT DPH regulation, but identified worker protection requirements for trades involved in the demolition and disposal procedures if lead is involved in the waste stream.

1.3 DEFINITIONS

A. The following definitions relative to lead paint as used in this Section are offered:

1. Action Level (AL): The allowable employee exposure, without regard to use of respiratory protection, to an airborne concentration of lead over an eight (8) hour time weighted average (TWA), as defined by OSHA. The current action level is thirty micrograms per cubic meter of air (30 $\mu g/m^3$).
2. Area Monitoring: The sampling of lead concentrations, which is representative of the airborne lead concentrations that may reach the breathing zone of personnel potentially exposed to lead.
3. Biological Monitoring: The analysis of a person's blood and/or urine, to determine the level of lead concentration in the body.
4. Change Room: An area provided with separate facilities for clean protective work clothing and equipment and for street clothes, which prevents cross-contamination.

5. Competent Person: A person employed by the Contractor who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions, and who has authorization to take prompt corrective measures to eliminate them as defined by OSHA.
6. Exposure Assessment: An assessment conducted by an employer to determine if any employee may be exposed to lead at or above the action level.
7. "High Efficiency Particulate Air" (HEPA): A type of filtering system capable of filtering out particles of 0.3 microns diameter from a body of air at 99.97% efficiency or greater.
8. Lead: Refers to metallic lead, inorganic lead compounds and organic lead soaps. Excluded from this definition are other organic lead compounds.
9. Lead Work Area: An area enclosed in a manner to prevent the spread of lead dust, paint chips, or debris resulting from lead-containing paint disturbance.
10. Lead Paint: Refers to paints, glazes and other surface coverings containing a toxic level of lead.
11. Permissible Exposure Limit (PEL): The maximum allowable limit of exposure to an airborne concentration of lead over an eight (8) hour time weighted average (TWA), as defined by OSHA. The current PEL is fifty micrograms per cubic meter of air (50 $\mu g/m^3$). Extended workdays lower the PEL by the formula: PEL equals 400 divided by the number of hours of work.
12. Personal Monitoring: Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62 and 29 CFR 1910.1025. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a sphere with a radius of 18 inches and centered at the nose or mouth of an employee.
13. Resource Conservation Recovery Act (RCRA): RCRA establishes regulatory levels of hazardous chemicals. There are eight (8) heavy metals of concern for disposal: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Six (6) of the metals are typically found in paints, excluding selenium and silver.
14. Toxic Level Of Lead: A level of lead, when present in dried paint or plaster, contains more than 0.50% lead by dry weight as measured by atomic absorption spectrophotometry (AAS) or 1.0 mg/cm^2 as measured by on-site testing utilizing an x-ray fluorescence analyzer. (Term is specific to State of CT regulations and HUD guidelines only)
15. Toxicity Characteristic Leachate Procedure (TCLP): The U.S. Environmental Protection Agency (US EPA) required sample preparation and analysis for determining the hazard characteristics of a waste material.

1.4 REGULATIONS AND STANDARDS

A. The following regulations, standards, and ordinances of federal, state, and local agencies are applicable and made a part of this specification by reference:

1. American National Standards Institute (ANSI) ANSI 288.2 - 1980 Respiratory Protection
2. Code of Federal Regulation (CFR)

    a. 29 CFR 1910.134 - Respiratory Protection
    b. 29 CFR 1910.1025 - Lead
    c. 29 CFR 1926.62 - Lead in Construction Interim Final Rule
    d. 29 CFR 1910.1200 - Hazard Communication
    e. 29 CFR 1926.59 - Hazard Communication in Construction
    f. 29 CFR 1926.55 - Gases, Vapors, Fumes, Dusts, and Mists
    g. 29 CFR 1926.57 - Ventilation
    h. 40 CFR 260 - Hazardous Waste Management Systems: General

3. 40 CFR 261 - Identification and Listing of Hazardous Waste
4. 40 CFR 262 - Generators of Hazardous Waste
5. 40 CFR 263 - Transporters of Hazardous Waste
6 40 CFR 264 - Owner and Operators of Hazardous Waste Treatment, Storage, and
7. Disposal Facilities

    a. 40 CFR 265 - Interim Statutes for Owner and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
    b. 40 CFR 268 - Lead Disposal Restrictions
    c. 40 CFR 172 - Hazardous Materials Tables and Communication Regulations
    d. 40 CFR 178 - Shipping Container Specifications
    e. 40 CFR 270 and 124 - Hazardous Waste Permits

8. Underwriters Laboratories, Inc. (UL) UL586 - 1990 High Efficiency Particulate Air Filter Units

1.5 QUALITY ASSURANCE

A. Hazard Communication Program
The Contractor shall establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

B. Compliance Plan (Site Specific)
The contractor shall establish a written compliance plan, which is specific to the project site, to include the following:

1. A description of work activity involving lead including equipment used, material included, controls in place, crew size, employee job responsibilities, operating procedures, and maintenance practices.
2. Methods of engineering controls to be used to control lead exposure.
3. The proposed technology the Contractor will implement in meeting the PEL.
4. Air monitoring data documenting the source of lead emissions.
5. A detailed schedule for implementing the program, including documentation of appropriate supply of equipment, etc.
6. Proposed work practice which establishes proper protective work clothing, housekeeping methods, hygiene facilities, and practices.
7. Worker rotation schedule, if proposed, to reduce TWA.
8 A description of methods for informing workers of potential lead exposure.

C. Hazardous Waste Management
The Contractor shall establish a Hazardous Waste Management Plan, which shall comply with applicable regulations and address the following:

1. Identification of hazardous wastes
2. Estimated quantity of waste to be disposed of
3. Names and qualifications of each sub-contractor that will be transporting, storing, treating, and disposing of wastes
4. Disposal facility location and 24 hour point of contact
5. Establish EPA state hazardous waste and identification numbers if applicable
6. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes
7. List of waste handling equipment to be used in performing the work to include cleaning, volume reduction, if applicable, and transport equipment
8. Qualifications of laboratory to be utilized for TCLP sampling and analysis
9. Spill prevention, containment, and cleanup contingency measures
10. Work plan and schedule for waste containment, removal, treatment, and disposal

D. Medical Examinations

1. Before exposure to lead contaminated dust, provide workers with a comprehensive medical examination as required by 29 CFR 1910.1025 and 29 CFR 1926.62.
2. The examination shall not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62 within the last year.
3. Medical examination shall include, at a minimum, approval to wear respiratory protection and biological monitoring.

E. Training

1. The Contractor shall ensure that workers are trained to perform lead paint disturbing activities and disposal operations prior to the start of work in accordance with 29 CFR 1926.62.

F. Respiratory Protection Program

1. The Contractor shall furnish each employee required to wear a negative pressure respirator with a respirator fit test at the time of initial fitting and at least once every six (6) months thereafter as required by 29 CFR 1926.62.
2. The Contractor shall establish a Respiratory Protection Program in accordance with ANSI Z88.2, 29 CFR 1910.134, and 29 CFR 1926.62.

1.6 SUBMITTALS

A. The Contractor shall submit to the Owner the following submittals prior to start of work:

1. Copies of medical records for each employee to be used on the project, including results of biological monitoring and a notarized statement by the examining physician that such an examination took place.
2. Copies of workers' training certificates.
3. Submit record of successful respirator fit testing performed by a qualified individual within the previous six (6) months, for each employee to be used on this project with the employee's name and social security number with each record.
4. The name and address of Contractor's blood lead testing lab, OSHA-CDC listing, and Certification in the State of Connecticut.
5. The name and address of Contractor's personal air monitoring and waste disposal lead testing laboratory/ies.
6. Name, address, and ID number of the hazardous waste hauler, waste transfer route, and proposed disposal site.

B. The Contractor shall submit to the Owner the following submittals during the job:

1. Results from personal air samples.
2. Medicals, certificates, and fit test 24 hours in advance of any new employee starting on the project.

C. The Contractor shall submit to the Owner the following submittals upon completion of the work:

1. Copies of manifests and receipts acknowledging disposal of all hazardous waste material from the project showing delivery date, quantity, and appropriate signature of landfill's authorized representative.

1.7 PERSONAL PROTECTION

A. Exposure Assessment

1. The Contractor shall determine if any worker will be exposed to lead at or above the action level.
2. The exposure assessment shall identify the level of exposure a worker would be subjected to without respiratory protection.
3. The exposure assessment shall be achieved by obtaining personal monitoring samples representative of a full shift at least (8-hour TWA).
4. During the period of the exposure assessment, the Contractor shall institute the following procedures for protection of workers.

    a. Protective clothing shall be utilized
    b. Respiratory protection
    c. Change areas shall be provided
    d. Hand washing facilities and shower
    e. Biological monitoring
    f. Training of workers

B. Respiratory Protection

1. The Contractor shall furnish appropriate respirators approved by NIOSH/MSHA for use in atmospheres containing lead dust.
2. Respirators shall comply with the requirements of 29 CFR 1926.62.
3. Workers shall be instructed in all aspects of respiratory protection.
4. The Contractor shall have an adequate supply of HEPA filter elements and spare parts on site for all types of respirators in use.
5. The following minimum respirator protection for use during paint removal or demolition of components and surfaces with lead paint shall be the 1/2 mask air purifying respirator with high efficiency filters for exposures (not in excess of 500 ug/m^3 or 10 x PEL).

C. Protective Clothing

1. Personal protective clothing shall be provided for all workers, supervisors, and authorized visitors entering the work area.
2. Each worker shall be provided with a minimum of two (2) complete disposable coverall suits.
3. Removal workers shall not be limited to two (2) suits, and the Contractor shall supply additional suits as necessary.
4. Under no circumstances shall anyone entering the abatement area be allowed to re-use a contaminated disposable suit.
5. Disposable suits, such as TYVEK suits, and other personal protective equipment (PPE) shall be donned prior to entering the lead control area. A change room shall be provided for workers to put on suits and other personal protective equipment with separate areas to store their street clothes.
6. Eye protection for personnel engaged in lead operations shall be furnished when the use of a full-face respirator is not required.
7. Goggles with side shields shall be worn when working with power tools or a material that may splash or fragment, or if protective eye wear is specified on the Safety Data Sheet (SDS) for a particular product to be used on the project.

1.8 PERSONAL MONITORING

A. General: The Contractor is required to perform the personal air sampling activities during lead paint disturbing work. The results of such sampling shall be posted, provided to individual workers and submitted to the Owner as described herein.

B. Sampling: Samples shall be taken for the duration of the work shift or for eight hours, whichever is less. Personal samples need not be taken every day after the first day if working conditions remain unchanged, but must be taken every time there is a change in removal operations, either in terms of the location or the type of work. Sampling will be used to determine eight-hour Time-weighted averages (TWA). The Contractor is responsible for personal sampling as outlined in OSHA Standard 29 CFR 1926.62 and 29 CFR 1910.1025.

C. Sampling Results: Air sampling results shall be reported to individual workers in written form no more than forty-eight (48) hours after the completion of a sampling cycle. The reporting document shall list each sample's result, sampling time and date, personnel monitored and their social security numbers, flow rate, sample duration, sample yield, cassette size, and analysts' name and company, and shall include an interpretation of the results. Air sample analysis results will be reported in micrograms/cubic meter ($\mu g/m^3$).

D. Testing Laboratory: The Contractor's testing lab shall be participating in AIHA's Environmental Lead Laboratory Accreditation Program (ELLAP). The Contractor shall submit to the Consultant for review and acceptance, the name and address of the laboratory, certification(s) of AIHA participation, a listing of relevant experience in air lead analysis, and presentation of a documented Quality Assurance and Quality Control Program.

PART 2 - PRODUCTS

2.1 GENERAL

A. Any substitution in materials, equipment, or methods to those specified shall be approved by the Owner prior to use. Any requests for substitution shall be provided in writing to the Owner. The request shall clearly state the rationale for the substitution.

B. Submit to the Owner product data of all materials and equipment and samples of all materials to be considered as an alternate.

C. Product data shall consist of manufacturer; catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, safety data sheets (SDS), and other standard descriptive data. Submittal data shall be clearly marked to identify pertinent materials, products or equipment and show performance characteristics and capacities.

D. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product or material with integrally related parts and attachment devices.

2.2 MATERIALS AND PRODUCTS

A. Deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name and product technical description.

B. Damaged or deteriorating materials shall not be used and shall be removed from the premises.

C. The Contractor shall have available sufficient inventory or dated purchase orders for materials necessary for the job including protective clothing, respirators, filter cartridges, polyethylene sheeting of proper size and thickness, tape, and air filters.

D. Materials:

1. Polyethylene sheet in a roll size to minimize the frequency of joints shall be delivered to job site with factory label indicating 6 mil.
2. Polyethylene disposable bags shall be six (6) mil. Tie wraps for bags shall be plastic, five (5) inches long (minimum), pointed and looped to secure filled plastic bags.
3. Tape or adhesive spray will be capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water.
4. Impermeable containers are to be used to receive and retain any lead containing or contaminated materials until disposal at an acceptable disposal site. (The containers shall be labeled in accordance with EPA and DOT standards.)
5. HEPA filtered exhaust systems shall be used during powered dust generating abatement operations. The use of powered equipment without HEPA exhausts is prohibited.

2.3 TOOLS AND EQUIPMENT

A. Provide suitable tools for all lead disturbing operations.

B. The Contractor shall have available power cables or sources such as generators (where required).

C. Vacuum units, of suitable size and capacities for the project, shall have HEPA filter(s) capable of trapping and retaining 99.97% of all mono-dispersed particles of 0.3 micrometers in diameter.

PART 3 - EXECUTION

3.1 WORKER PROTECTION/TRAINING

A. The Contractor shall provide appropriate training, respiratory and other personal protection, and biological monitoring for each worker and ensure proper usage during potential lead exposure and the initial exposure assessment.

B. Workers who will perform procedures must have completed one of the following training courses:

1. EPA Lead Abatement Supervisor (40 hours)
2. EPA Lead Abatement Worker (32 hours)
3. HUD/EPA course "Work Smart, Work Wet, and Work Clean to Work Lead Safe" (8 hours)
4. HUD/NARI course "The Remodeler's and Renovator's Lead Based Paint Training Program" (8 hours).
5. HUD "Lead Safe Work Practices" (8 hours)

3.2 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor is responsible for establishing and maintaining controls referenced herein to prevent dispersal of lead contamination from the lead work area.

B. The Contractor is also responsible for conducting work with applicable federal, state, and local regulations as referenced herein.

3.3 WORKER HYGIENE PRACTICES (REQUIRED DURING INITIAL EXPOSURE ASSESSMENT AND IF RESULTS OF AIR SAMPLING ARE ABOVE OSHA ACTION LEVEL)

A. Work Area Entry: Workers shall don personal protective equipment prior to entering work area, including respiratory protection, disposable coveralls, gloves, headgear, and footwear.

B. Work Area Departure: While leaving respirators on, workers shall remove all gross contamination, debris, and dust from disposable coveralls and proceed to change room and remove coveralls and footwear and place in hazardous waste disposal container.

C. Hand washing Facilities: All workers must wash their hands and faces upon leaving the work area.

D. Equipment: All equipment used by workers inside the work area shall be wet wiped or bagged for later decontamination before removal from the work area.

E. Prohibited Activities: Under no circumstances shall workers eat, drink, smoke, chew gum, or tobacco, or remove their respirators in the work area.

F. Shock Hazards: The Contractor is responsible for using safe procedures to avoid electrical hazards. All temporary electrical wiring will be protected by ground fault circuit interrupters (GFI).

3.4 LEAD WORK AREA (REQUIRED DURING INITIAL EXPOSURE ASSESSMENT AND IF RESULTS OF AIR SAMPLING ARE ABOVE OSHA ACTION LEVEL)

A. The Contractor shall place warning signs at all entrances and exits from the work area. Signage shall be a minimum of 20" x 14" and shall state the following:

DANGER
LEAD WORK AREA
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK OR SMOKE IN THIS AREA

B. The Contractor shall designate a change room as specified in this Section. The change room shall consist of two (2) layers of sheeting on the floor surface adjacent to the lead work area. The change room shall have separate storage facilities for street clothes to avoid cross contamination.

C. The Contractor shall provide potable water for hand and face washing and provide a portable shower unit.

D. The Contractor shall place six-mil polyethylene drop cloths on floor/ground surfaces prior to beginning removal work to facilitate clean-up.

3.5 WORK AREA CLEAN UP

A. The Contractor shall remove all loose chips and debris from floor surfaces and place in hazardous waste disposal bags.

B. The Contractor shall HEPA vacuum adjacent surfaces to remove dust and debris.

C. Polyethylene drop cloths shall be properly disposed of.

3.6 WASTE DISPOSAL

A. The Contractor's contractual liability shall be the proper disposal of all non-hazardous and hazardous wastes generated at the site in accordance with all applicable federal, state, and local regulations as referenced herein. Metal lead based paint components may be segregated for recycling at an approved facility. Lead TCLP sampling will be performed by the owner’s representative Langan (if required by landfill – for selective demolition debris and/or paint chip/debris/waste). The contractor will be responsible for all costs associated with lead/hazardous waste disposal should they, their haulers and/or the landfill of their choosing take samples and declare the waste as hazardous waste.

END OF SECTION 028313

SECTION 028416 - UNIVERSAL WASTE REMOVAL AND RECYCLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Refer to all drawings and/or other Sections of these specifications to determine the type and extent of work therein affecting the work of this Section, whether or not such work is specifically mentioned herein.

C. Sections containing requirements related to this Section include, but are not limited to:

1. Section 028200 – Selective Hazardous Building Materials Abatement Demolition
2. Section 028213 – Asbestos Abatement
3. Section 028313 – Lead-Based Paint Awareness
4. HBM – 01 – Hazardous Building Materials Abatement Drawing

1.2 SUMMARY OF WORK

A. Work of this Section includes, but is not necessarily limited to, all which is necessary for complete removal and recycling/disposal of all PCB-containing ballasts, newer ballasts, mercury containing devices, electronics, alarms, smoke detectors, sensors, emergency lighting, signage, paints, chemicals, chemicals/contaminated piping/waste traps, batteries, air conditioning units, CFC's, boiler and HVAC controls, other hazardous materials, wastes and special wastes that exist in the interior/exterior of the building structure(s) that will be impacted by proposed renovation of the building. The hazardous materials contractor will supply the packaging materials and pay for the proper disposal of these materials. The hazardous materials contractor will provide the labor to put the materials into the proper packaging for disposal.

1. All work including the removal, characterization (any testing that may be required by disposal facility) and disposal of hazardous materials and chemicals.
2. Removal, characterization (any testing that may be required by disposal facility) and disposal of fluorescent light ballasts and capacitors throughout all site structures.
3. Removal, characterization (any testing that may be required by disposal facility) and disposal of all containers, drums and unknown materials as well as fire extinguishers.
4. Removal, characterization (any testing that may be required by disposal facility) and disposal of contained gear oils, hydraulic oils and refrigeration liquids, etc. from various pieces of equipment.
5. Removal, characterization (any testing that may be required by disposal facility) and recycling/disposal of batteries, electronic devices, lighting signage, etc.
6. Removal, characterization (any testing that may be required by disposal facility) and recycling/disposal of science equipment, contaminated piping, chemicals, waste traps, etc.
7. File all necessary notices, obtain all permits and licenses, and pay all governmental taxes, fees, and other costs in connection with the work. Obtain all necessary approvals of all governmental departments having jurisdiction.
8. Comply with Health and Safety Plans.

B. The Contractor, under this Section, shall provide all materials, labor, equipment and appliances as necessary to properly remove and recycle/dispose of materials.

1.3 DESCRIPTION OF WORK

A. This specification covers the proper and legal removal and disposal of all Hazardous/Universal Waste to be affected by renovation/selective demolition activities from the Eastern Middle School project site located in Greenwich, Connecticut. The removal and disposal activities shall comply with all aspects of the contract documents and federal, state and local requirements.

B. Universal Wastes shall include, but not be limited to, fluorescent bulbs, light fixture ballasts containing polychlorinated bi-phenyls (PCBs) or DEHP, mercury lamps, mercury containing devices, electronics, alarms, smoke detectors, sensors, emergency lighting, signage, paints, chemicals, chemicals/contaminated piping/waste traps, batteries, air conditioning units, CFC's, boiler and HVAC controls, other hazardous materials, wastes and special wastes that exist in the interior/exterior of the building structure(s) that might be impacted by proposed selective demolition and renovation of the building. Whenever there is a conflict or overlap within these specifications and between applicable codes and regulations, the most stringent provision specified shall apply.

C. The Eastern Middle School building was constructed in 1968. The school is a two-story building and is approximately 108,000 square feet.

D. The proposed redevelopment consists of renovation activities for the main entrance.

E. The Contractor shall independently identify and quantify all Universal Waste Items.

1.4 SUBMITTALS

A. Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval.

1. Copy of State or local license for hazardous waste hauler;
2. Certification of at least one on-site supervisor which has satisfactorily completed the OSHA 40 Hour Health and Safety Course for Handling Hazardous Materials;
3. Certificates of workers which have successfully completed at least the OSHA 40-Hour Health and Safety Course for Hazardous Materials;
4. Certificates of workers which have successfully completed the required employee training for universal/hazardous waste or appropriate type of training to the type of wastes being managed;
5. Name and address of the universal waste handler and/or a destination facility where the waste materials is to be treated, deposited or recycled in accordance with all regulatory requirements (include contact person and telephone numbers), if the universal waste meets the definition of hazardous waste, the name and address of the hazardous waste treatment, storage and disposal (TSD) facility;
6. Work Plan: Provide a detailed written work plan that describes the procedures for the removal,

    a. Proposed level of worker training for each type of regulated and/or hazardous material to be removed.
    b. Names and applicable licenses of key personnel.
    c. Proof of appropriate training for workers.
    d. Proof of a current medical surveillance program for all personnel.
    e. Safety Data Sheets (SDS) for any chemicals to be used on the project. All products to be used on this project must have SDS approved by the Owner's Environmental Consultant.
    f. Proposed detailed work schedule.

7. Following final removal, and disposal or destruction, provide Owner with waste transport and disposal documents (e.g., manifests), as well as certificates of destruction and recycling as appropriate.

1.5 CODES AND REGULATIONS

A. Regulatory compliance includes but is not necessarily limited to applicable requirements set forth by:
   1. Federal Regulations:
      a. 29 CFR 1910, “Occupational Safety and Health Standards” (General Industry Standards)
      b. 29 CFR 1910.134 “Respiratory Protection”
      c. 29 CFR 1910.1200 “Hazard Communication”
      d. 29 CFR 1926, “Safety and Health Regulations for Construction” (Construction Industry Standards)
      e. 40 CFR 50, “National Primary and Secondary Ambient Air Quality Standards”
      f. 40 CFR 60, “Standards of Performance for New Stationary Sources,” Appendix B, “Test Methods”
      g. 40 CFR 117, “Determination of Reportable Quantities for Hazardous Substances”
      h. 40 CFR 122, “USEPA Administered Permit Program: The National Pollutant Discharge Elimination System”
      i. 40 CFR 172, “Hazardous Waste Transportation”
      j. 40 CFR 261, “Identification and Listing of Hazardous Waste”
      k. 40 CFR 262, “Standards Applicable to Generators of Hazardous Waste”
      l. 40 CFR 263, “Standards Applicable to Transporters of Hazardous Waste”
      m. 40 CFR 268, “Land Disposal Restrictions”
      n. 40 CFR 273, “Universal Waste Rule”
      o. 40 CFR 300, “National Oil and Hazardous Substances Pollution Contingency Plan”
      p. 40 CFR 302, “Designation, Reportable Quantities, and Notification”
      q. 40 CFR 112 (oil pollution prevention)
      r. 40 CFR 279 (used oil)
      s. 40 CFR 273 (Universal Wastes)
      t. 40 CFR 761 (PCBs)

   2. Toxic Substances Control Act (TSCA), US-EPA

   3. Resource Conservation and Recovery Act (RCRA)
      a. Comprehensive Environmental Response, Compensation & Liability Act (CERCLA) (Superfund Law)

   4. Connecticut Regulations:
      State requirements which govern universal waste removal and disposal include but are not necessarily limited to the following:

      a. Connecticut Department of Energy and Environmental Protection (CT DEEP) (Hazardous and Universal Waste Management Regulations); Section 22a-454, 456 Waste Facility and Section 22a-449(c)-113 of the Regulations of Connecticut State Agencies (RCSA), respectively.
      b. Connecticut DEEP; 310 CMR 40 Connecticut Contingency Plan, 310 CMR 30 Hazardous Waste Regulations, 310 CMR 1-7 Clean Water Act, 310 CMR 16, 19 Solid Waste Regulations, 314 CMR 1-8 Clean Air Act
      c. Local Town, City or County Bylaws, rules and regulations.

B. Under TSCA, items that contain more than 500 parts per million (PPM) of PCBs are classified as PCB material, items that contain between 50 ppm and 500 ppm of PCB are classified as PCB-contaminated and items that contain less than 50 ppm of PCBs are classified as non-PCB items.

Under the Small Capacitor Exemption, TSCA has allowed the disposal of non-leaking, intact "small capacitors", defined as containing less than three pounds of PCB dielectric fluid, in a municipal solid waste landfill. Light ballasts containing a small PCB capacitor are covered under this category. The intent of the "small capacitor" disposal rule is for "random disposal" in a landfill by "householders and other infrequent disposers". When commercial and industrial entities dispose of large quantities of small PCB capacitors, the EPA strongly encourages voluntary collection and disposal of PCB capacitors in chemical waste landfills or high-temperature incinerators.

C. Under the "Superfund" laws, PCBs are specifically listed as a hazardous substance. The "release" of more than one pound of PCBs into the environment triggers a "Superfund" notification and cleanup requirement.

Since twenty-five ballasts collectively contain approximately one pound of PCBs, the disposal of twenty five or more PCB-containing ballast in a landfill would trigger a "Superfund" action.

D. The State of Connecticut General Hazardous Waste Statue 22A 454, 456 requires that PCB ballast must be incinerated or sent to a chemical waste landfill. The statue defines PCB waste, including PCB ballast, as Connecticut Regulated Wastes.

E. Other Regulations: The other relevant regulations affecting disposal of PCBs include the following:

1. Department of Transportation (DOT) regulations – DOT regulation HM-181 regulates transportation of hazardous materials, including PCBs.
2. Occupational Safety and Health Administration (OSHA) – OSHA regulates worker's safety and exposure to a variety of chemicals including PCB's.
3. Resource Conservation and Recovery Act (RCRA) – RCRA regulates wastes, which fail Toxic Characteristic Leachate Procedure (TCLP) and which contain more than 50 ppm of PCBs.

PART 2 - PRODUCTS

2.1 GENERAL

A. 35 or 55-gallon metal, fiber drums or containers with lids that can be secured and sealed, DOT approved.

B. Appropriate waste labels identifying contents as regulated and hazardous wastes as defined by 49 CFR 172.

C. Fluorescent Lamp Disposal (Crusher) units, such as DexTrite Fluorescent® Lamp Disposal equipment, or equivalent. Such equipment must be capable of capturing fugitive mercury vapors during the bulb crushing process, as well as the fractured and broken waste products.

D. HEPA and charcoal filter equipped mercury capture vacuum.

E. Cardboard boxes and sleeves for packaging lamps that will be removed from the site intact or unbroken.

F. Recovery tanks to temporarily hold compressed gasses.

G. Health & Safety equipment complying with health and safety plan.

PART 3 - EXECUTION

3.1 GENERAL

A. Procedures and methods contained herein are to provide guidance to protect from the contamination of the environment, and exposure to workers, while handling hazardous waste and regulated waste-streams for disposal/recycling/destruction.

B. Owner to Stop Work: The Owner's representative and the Owner's Environmental Consultant shall have the authority to stop the work at any time that conditions are not within Specification and/or applicable regulations. The stoppage of work shall continue until conditions have been corrected to the satisfaction of the Owner's representative or Owner's Environmental Consultant. Standby time to resolve the problems shall be at the Contractor's expense.

C. Personal Protective Equipment:

1. Personal protective equipment shall consist of (at a minimum) safety goggles or other protective eye-ware, work shoes with non-slip soles (e.g., neoprene), chemical resistant gloves that cover the hand and an apron that covers the front of the worker's body from shoulder to toes (e.g., neoprene or nitrile gloves).
2. Personal protective equipment contaminated by handling operations should be disposed of as contaminated waste.
3. Hammering or sudden impact methods for removing ballasts from the light fixture shall not be employed, as such methods may cause leakage in an otherwise non-leaking ballast.
4. Throwing and tossing of ballasts into disposal drums shall not be conducted, as such activities may cause leakage in an otherwise non-leaking ballast.

D. Work Procedures

1. Contractor shall obtain a hazardous waste generator number from Region I, US EPA for the Owner.
2. During the light fixture removal stage during demolition, the following procedures (or equivalent alternate but protective measures) shall be followed:

    a. Carefully remove fixtures, and stack them in a designated portion of the work area.
    b. Designate an area where the fixtures can be disassembled, and components removed and segregated (e.g., lamps, ballasts). The area should be remote from other demolition activities, and have adequate ventilation and lighting.
    c. The work area for fixture disassembly shall (at a minimum) have the floor lined with one layer of 6-mil fire-retardant polyethylene plastic to control accidental spills or breakage. The work area should have a table or other solid work platform to facilitate disassembly of the fixtures, and the protective plastic sheeting should cover the work table area and waste drums/lamp crushing/lamp repackaging equipment.
    d. Carefully remove lamps from fixtures, and either crush them or repackage them for disposal.
    e. In the event a lamp breaks, utilize the mercury capture vacuum to remove all debris generated.

3. Carefully remove ballasts, and segregate for disposal in the following manner:

    a. Ballasts labeled as "No-PCBs" shall NOT be segregated and shall be treated as PCB waste as potting material may contain PCBs and DEHP. Handle and dispose of in the same manner as ballasts containing PCBs and/or DEHP.
    b. Non-leaking ballasts shall be segregated and drummed for disposal as hazardous wastes. These ballasts may be destroyed by high temperature incineration, or land filled at a properly permitted facility.
    c. Leaking ballasts shall be segregated and drummed. Punctures or damage to these ballasts exposes an oily or tar-like substance. These ballasts, and all materials it contacts, MUST be incinerated under TSCA; they cannot be landfilled.

E. Miscellaneous Stored Materials In Containers

1. Miscellaneous materials may include antifreeze, cleaning solutions, paints, and other miscellaneous materials.
2. During removing/recycling of materials enclosed in their original container, the Contractor shall package, and label (lab packed) by waste classification in accordance with appropriate RCRA and Connecticut Department of Transportation (ConnDOT). In turn these containers shall be transported, under proper manifesting procedures, to a recycling facility. The facility shall forward a certificate of recycling or disposal to the Contractor, who shall submit this information to the Owner.

F. Universal Waste

Universal waste includes, but is not limited to, fluorescent bulbs, light fixture ballasts containing polychlorinated bi-phenyls (PCBs) or DEHP, mercury lamps and switches, batteries, fire extinguishers, Halon fire suppression systems, paint, refrigerants, electronic devices (computers and monitors), and other compressed gases, mechanical fluids, oils, and lubricants, as defined in 40 CFR 273 and Section 22a-449(c)-113 of the Regulations of Connecticut State Agencies (RCSA). Follow procedures for handling, storage, labeling, shipping, recording keeping and other procedures as required in 40 CFR 273 and Section 22a-449(c)-113.

G. Regulated Waste

1. Non-thermostat mercury switches: Handle and dispose of in accordance with State regulation and applicable Federal regulations.
2. Used oil: Handle and dispose of in accordance with State regulations.
3. Refrigerants: Prior to disposal of refrigerant containing equipment, verify that refrigerant has been removed per the requirements of 40 CFR Part 82 (Protection of Stratospheric Ozone).
4. Diesel fuel: If possible, use on site to run equipment. Dispose of or recycle any remaining fuel as per applicable regulations.
5. Fire extinguishers: Contact manufacturer for recycling or donate to local fire department.
6. Halon Fire Suppression System: For recovery and management of Halon, utilize a technician EPA certified in appropriate level for the system. Technician is to use an EPA-certified reclaimer for disposal.

H. Transportation

1. Transport waste materials using properly permitted vehicles operated by drivers with Commercial Drivers Licenses (CDLs) and Hazardous Materials endorsements. Coordinate transportation routes with Connecticut Department of Transportation (ConnDOT). Provide Owner with copies of transporter certifications and EPA ID number a minimum of seven

(7) days prior to first use. Chain of custody records shall be maintained which include the date of pickup, number of drums, name of transporter and destination.

I. Waste Disposal Documentation

1. Waste shipment records and manifests for all materials transported from the site as required by regulations and disposal facility are to be provided to the Owner every five (5) business days. Incorporate this information into the close out package to be provided to the Owner. Within thirty (30) days of generation, Contractor shall provide waste manifests/shipment records and Certificates of Recycling and Disposal (CRD) to Owner.

2. Certificates of Discontinuance for all equipment and fixtures.

J. Disposal Facilities

1. Contractor shall use only disposal facilities which have been pre-approved by the Owner and its insurers and with valid regulatory permits for type of waste being handled. Provide Owner with copies of disposal facility regulatory permits and EPA identification number a minimum of seven (7) days prior to shipping to that facility. Provide disposal facility required documentation including additional waste sampling.

END OF SECTION 028416

SECTION 042200 - CONCRETE 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. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PRE-INSTALLATION MEETINGS

A. Pre-installation 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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.

2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.

6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

C. 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 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. 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.

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 pre-blended, dry mortar mix in moisture-resistant containers. Store pre-blended, 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.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three (3) 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 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.

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 (7) 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 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.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 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. Density Classification: Normal weight.
2. Size (Width): Manufactured to dimensions 3/8-inch less-than-nominal dimensions.

2.4 MASONRY LINTELS

A. Masonry Lintels: Pre-fabricated 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 pre-cast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, 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. 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 ¼-inch-thick, use aggregate graded with one hundred percent (100%) 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.

D. Aggregate for Grout: ASTM C 404.

E. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.148-inch-diameter.
3. Wire Size for Cross Rods: 0.148-inch-diameter.
4. Spacing of Cross Rods: Not more than 16 inches o.c.
5. Provide in lengths of not less than 10 feet, with pre-fabricated corner and tee units.

2.7 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1½ inches into masonry 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. Stainless-Steel Wire: ASTM A 580, Type 304.
2. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304.

C. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from stainless-steel.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to thirty-five percent (35%); of width and thickness indicated; formulated from closed cell PVC.

B. Pre-formed 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, Type I (No. 15 asphalt felt).

2.9 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 mortar unless otherwise indicated.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended 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, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For reinforced masonry, use Type S.
2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
3. For interior non-load-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.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

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 reinforcing dowels are properly placed.
3. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. 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.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus ½-inch or minus ¼-inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus ½-inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus ¼-inch in a story height or ½-inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than ¼-inch in 10 feet, or ½-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, ¼-inch in 20 feet, or ½-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than ¼-inch in 10 feet, 3/8-inch in 20 feet, or ½-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, ¼-inch in 20 feet, or ½-inch maximum.
5. For lines and surfaces, do not vary from straight by more than ¼-inch in 10 feet, 3/8-inch in 20 feet, or ½-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼-inch in 10 feet, or ½-inch maximum.

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 ½-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 ¼-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.

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 non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide ½-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

4. At fire-rated partitions, treat joint between top of partition and underside of structure.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow 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 grouted masonry.
3. Fully bed entire units, including areas under cells, at starting course where cells are not grouted.

B. Lay solid CMUs 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 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, ½-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. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 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 as follows:

1. Install pre-formed control-joint gaskets designed to fit standard sash block.

3.8 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

B. 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.

3.9 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. Inspections: Special inspections according to Level C in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Frequency: One (1) 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.

3.10 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. 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 non-metallic 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. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.11 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.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 055000 - METAL FABRICATIONS

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 framing and supports for mechanical and electrical equipment, not provided by equipment manufacturer.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel trim.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connection. Show anchorage and accessory items.

B. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment, not provided by equipment manufacturer.
2. Steel and aluminum framing and supports for applications where framing and supports are not specified in other Sections.
3. Miscellaneous steel trim.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A 563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six (6) times the load imposed when installed in unit masonry and four (4) times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E 488, conducted by a qualified independent testing agency.

G. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Pre-assemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. 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.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Galvanize miscellaneous steel framing and supports where indicated.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from 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.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize miscellaneous steel trim.

2.8 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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.

B. 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.

C. 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.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

3.2 INSTALLATION OF 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.

3.3 REPAIRS

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

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 railings.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Fasteners.
2. Post-installed anchors.
3. Handrail brackets.
4. Non-shrink, non-metallic grout.
5. Anchoring cement.

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.
2. Fittings and brackets.

D. Third-Party Review Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For third-party review engineer and testing agency.

B. Welding certificates.

C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E 894 and ASTM E 935.

D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Third-Party Review: Engage a qualified professional engineer to review load calculations of the stair and railing assemblies, 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.

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.

1. Provide type of bracket with pre-drilled hole for exposed bolt anchorage and that provides 1½-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

A. Pipe: ASTM A 53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Plates, Shapes, and Bars: ASTM A 36.

2.4 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Finish exposed fasteners to match 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 exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide Phillips tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For 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. Shop Primers, Intermediate Coats, and Topcoats: Provide products that comply with Section 099123 “Interior Painting”.

C. Non-Shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, non-shrink, non-staining, 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.

2.6 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.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

F. Connections: Fabricate railings with welded connections unless otherwise indicated.

G. 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

H. Form Changes in Direction as Follows:

1. As detailed.

I. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of railing members with pre-fabricated cap and end fittings of same metal and finish as railings.

K. 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 ¼-inch or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

2.7 STEEL AND IRON FINISHES

A. For non-galvanized-steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

B. Primer and Shop-Painted Finish: Comply with Division 09 sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. 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.
5. Set posts plumb within a tolerance of 1/16-inch in 3 feet.
6. 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 ¼-inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 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.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than ¾-inch 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 non-shrink, non-metallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach handrails to walls or metal posts with wall brackets. Provide brackets with 1½-inch clearance from inside face of handrail and finished wall or railing surface.

1. Use type of bracket with pre-drilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements, using self-tapping screws of size and type required to support structural loads.

3.6 REPAIR

A. Touchup Painting:

1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 sections.

3.7 CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

3.8 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.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

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. Wood blocking and nailers.

B. Related Requirements:

1. Section 012200 “Unit Prices” for Work of this Section included in unit prices.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. SPIB: The Southern Pine Inspection Bureau.
3. NLGA: National Lumber Grades Authority.
4. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: 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.

B. Evaluation Reports: For the following, from ICC-ES:

1. Power-driven fasteners.
2. Powder-actuated fasteners.
3. Post-installed anchors.
4. Expansion anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from 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. 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.

B. Maximum Moisture Content of Lumber: Nineteen percent (19%) unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Hem-fir; WCLIB or WWPA.
3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. 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.

D. 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.

2.3 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

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: ASME B18.2.1

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.

1. Material: Stainless-steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six (6) times the load imposed when installed in unit masonry assemblies and equal to four (4) 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. 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 nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Do not splice structural members between supports unless otherwise indicated.

D. 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 or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

E. 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.

F. 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 (IBC).
3. ICC-ES evaluation report for fastener.

G. 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.

3.2 WOOD 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.

END OF SECTION 061000

SECTION 072100 - THERMAL 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:

1. Mineral-wool blanket insulation.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E 84.

B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 MINERAL-WOOL BLANKET INSULATION

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. Johns Manville, a Berkshire Hathaway company
2. Rockwood International
3. Thermafiber, Inc., an Owens Corning company
4. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Mineral-Wool Blanket Insulation, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E 136 for combustion characteristics.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

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. Fireproof firestopping and firesafing materials and accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Fireproofing Materials: ASTM E 119 and ASTM E 814 to achieve a fire rating as noted on Drawings.

B. Surface Burning: ASTM E 84 with a flame spread/fuel contributed/smoke developed rating of 5/0/0.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated provide characteristics, performance, and limitation criteria.

B. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience.

B. Applicator: Company specializing in performing the work of this Section with minimum five (5) years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable State Building code for fire resistance ratings and surface burning characteristics.

B. UL Classifications for these systems shall be (all two (2) hours or more):

1. Duct Penetrations: C-AJ-7027
2. Pipe Penetrations: C-AJ-1079
3. Cable Penetrations: C-AJ-1079
4. Conduit Penetrations: C-AJ-1079

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during and for three (3) days after installation of materials.

C. Provide ventilation in areas to receive solvent cured materials.

1.8 SEQUENCING

A. Sequence Work to permit firestopping materials to be installed after adjacent and surrounding work is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Hilti, Inc.
2. Thermal Ceramics
3. United States Gypsum
4. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.2 MATERIALS

A. Firestopping Material: Single component silicone elastomeric compounds; conforming to the following:

1. Elongation & Shrinkage: Five percent (5%).
2. Tensile Strength: 300 psi.
3. Density: 8 lb./cu ft.
4. Surface Durability: 35 (Shore Hardness).
5. Durability and Longevity: Permanent.
6. Side Effects during Installation: Non-toxic.
7. Long Term Side Effects: None.

B. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.

C. Firesafing Blankets: ASTM C 665; 4 psf nominal density firesafing insulation.

D. Putty Pads: UL CLIV; acoustic, intumescent pad; 3.2mm thickness.

2.3 ACCESSORIES

A. Dam Material: Mineral fiber matting, permanent.

B. Retainers: Stainless clips to support mineral fiber matting

2.4 FINISHES

A. Color: Dark gray or manufacturer’s standard color.

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: Clean out openings immediately before installing penetration firestopping 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.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Install backing materials to arrest liquid material leakage.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Apply firestopping material to all wall and floor penetrations through rated assemblies. These penetrations include electrical conduit and raceways, plumbing and heating system penetrations, ducts, and other system chases.

C. Apply primer and materials in accordance with manufacturer's instructions.

D. Apply firestopping material in sufficient thickness to achieve rating to a density of fifty percent (50%) to uniform density and texture.

E. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit, and other items requiring firestopping.

F. Remove dam material after firestopping material has cured.

3.4 CLEANING AND PROTECTION

A. Clean off excess materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping 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 is 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 and install new materials to produce systems complying with specified requirements.

3.5 SCHEDULE

A. See Construction Documents for rating information and construction details and conditions.

B. Firesafe all penetrations through new and existing masonry and gypsum board construction in the project work areas, equal to the one (1) or two (2) hour rating of the appropriate spaces.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

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. Latex joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of available colors for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained between 40 and 95 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Installer's Special Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Colors of Exposed Joint Sealants: As selected by Architect and Owner from manufacturer's entire range, to match adjacent where required.

2.2 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF, paintable.

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. BASF Building Systems; **Sonolac**
b. Bostik, Inc.; **Chem-Calk 600**
c. Pecora Corporation; **AC-20+**
d. Tremco Incorporated; **Tremflex 834**
e. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.3 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bi-cellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Non-porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean non-porous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Non-porous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-Sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces.

1. Joint Locations:

    a. Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    b. Perimeter joints between interior wall surfaces and frames of interior doors.
    c. Other joints as indicated.

2. Joint Sealant: Latex.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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 hollow-metal work.

B. Related Requirements:

1. Section 087100 “Door Hardware" for door hardware for hollow-metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two (2) removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum ¼-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Ceco Door Products; an ASSA ABLOY Group company
2. Curries Company; an ASSA ABLOY Group company
3. Steelcraft; an Allegion company
4. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

a. Basis-of-Design:

1) Steelcraft; an Allegion company; **L Series**

b. Type: As indicated in the Door and Frame Schedule.
c. Thickness: 1¾ inches.
d. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 16-gauge.
e. Edge Construction: Model 2, Seamless.
f. Core: Manufacturer's standard Kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

3. Frames:

    a. Basis-of-Design:

        1) Steelcraft; an Allegion company; **F Series**

    b. Materials: Uncoated, steel sheet, minimum thickness of 16-gauge.
    c. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
    d. Construction: Full profile welded.

4. Metal Infill Panel:

    a. Materials: Uncoated, steel sheet, minimum thickness of 16-gauge.
    b. Core: Temperature-rise composite or steel-stiffened mineral wool.
    c. Construction: Flush welded on four (4) sides to frame.

5. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three (3) anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one (1) additional anchor for each 24 inches of frame height above 7 feet.
3. Post-Installed Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A 879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011; hot-dip galvanized according to ASTM A 153, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

C. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

D. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.

E. Glazing: Comply with requirements in Section 088000 "Glazing".

F. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 20-gauge, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection ratings indicated.
3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8-inch in 2 inches.
4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four (4) spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing.
    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c.
    c. Post-Installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three (3) door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two (2) door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer’s standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016-inch-thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, 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. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting insulation installation.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
    h. Solidly pack mineral-fiber insulation inside frames.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
5. In-Place Concrete Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
2. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 083950 - BULLET-RESISTANT STEEL DOORS AND FRAMES

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 bullet-resistant steel frames and doors.

B. Related Requirements:

1. Section 087100 “Door Hardware" for door hardware for bullet-resistant steel doors and frames.
2. Section 099123 “Interior Painting” for field painting of bullet-resistant steel doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.4 PRE-INSTALLATION MEETINGS

A. Pre-Installation Conference: Conduct conference at Project site.

1.5 COORDINATION

A. Coordinate anchorage installation for bullet-resistant steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Product Schedule: For bullet-resistant steel work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer to have been regularly engaged in manufacturing bullet-resistant steel doors and frames for a period of five (5) years.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver bullet-resistant steel work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two (2) removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store bullet-resistant steel work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum ¼-inch space between each stacked door to permit air circulation.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of bullet-resistant steel doors and frames that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Ambico Limited
2. Ceco Door Products; an ASSA ABLOY Group company
3. Curries Company; an ASSA ABLOY Group company
4. Stiles Custom Metal, Inc.
5. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Source Limitations: Obtain bullet-resistant steel doors and frames from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Ballistics Resistance, UL 752: Listed and labeled as **Level 4** when tested according to UL 752.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1¾ inches.
    c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 16-gauge.
    d. Edge Construction: Model 2, Seamless.
    e. Core: Manufacturer's standard fire and bullet-rated with vertical steel-stiffeners.

3. Frames:

    a. Materials: Uncoated, steel sheet, minimum thickness of 16-gauge.
    b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
    c. Construction: Full profile welded.

4. Metal Infill Panel:

    a. Materials: Uncoated, steel sheet, minimum thickness of 16-gauge.
    b. Core: Bullet-resistant panels as indicated in Section 102641 “Bullet-Resistant Panels”.
    c. Construction: Face welded on four (4) sides, with removable stops to match adjacent.

5. Reinforcement: Manufacturer’s standard where required to meet code and performance requirements.
6. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three (3) anchors per jamb, with one (1) additional anchor for frames with no floor anchor. Provide one (1) additional anchor for each 24 inches of frame height above 7 feet.
3. Post-Installed Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer’s standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A 879, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011; hot-dip galvanized according to ASTM A 153, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

C. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

D. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143.

E. Glazing: Comply with requirements in Section 088000 “Glazing”.

F. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate bullet-resistant steel work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Bullet-Resistant Steel Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 20-gauge, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Bullet-Resistant Cores: As required to provide bullet-resistant ratings indicated.
3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8-inch in 2 inches.
4. Top and Bottom Edge Closures: Close top and bottom edges of doors with end closures or channels of same material as face sheets.

C. Bullet-Resistant Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four (4) spot welds per anchor.
5. Jamb Anchors: Provide spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing.
b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c.
c. Post-Installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Double-Door Frames: Drill stop in head jamb to receive two (2) door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare bullet-resistant steel work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of steel work for hardware.

F. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
2. Provide fixed frame moldings on secure side of interior doors and frames. Provide loose stops and moldings on inside of doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer’s standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016-inch-thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Install plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and manufacturer's written instructions.

B. Bullet-Resistant Steel Frames: Install bullet-resistant steel frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    b. Install frames with removable stops located on secure side of opening.
    c. Install door silencers in frames before grouting.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    f. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
5. In-Place Concrete Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

C. Bullet-Resistant Steel Doors: Fit bullet-resistant steel doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 083950

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.

2. Electrified door hardware.

B. Related Sections:

1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.

1.3 COORDINATION

A. 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.

B. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

C. 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.

1.4 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

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. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

B. Keying Conference: Conduct conference at Project site.

1. Conference participants shall also include Installer's Architectural Hardware Consultant.

2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

    a. Flow of traffic and degree of security required.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.
    d. Requirements for access control.
    e. Address for delivery of keys.

1.5 ACTION SUBMITTALS

A. <u>ALL DOOR HARDWARE MUST BE SUBMITTED UNDER A SINGLE SUBMITTAL PACKAGE, REGARDLESS OF DOOR MATERIAL.</u>

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

D. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

E. Door Hardware Schedule: Prepared by or under the supervision of Installer. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Shop Drawings, and Samples. 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.
2. Format: Use same scheduling sequence and format and use same door numbers as in the door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other pertinent information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

F. 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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.9 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.

1.10 WARRANTY

A. Special Warranty: Manufacturer's 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 (3) years from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Two (2) years from date of Substantial Completion.
b. Closer Holder Release Devices: Twenty-five (25) years (mechanical)/two (2) years (electrical) from date of Substantial Completion.
c. Power Operators: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENT

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. 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.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.

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.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 3 inches (12 degrees) from the latch.

2.3 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article 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, where allowed.

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.

2.4 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Basis-of-Design:

a. Ives, an Allegion company; **5BB1**

2. 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. Hager Companies
b. McKinney Products Company, an ASSA ABLOY Group company
c. Stanley Commercial Hardware, a division of Dormakaba
d. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.5 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Basis-of-Design:

a. Markar Architectural Products, Inc.; a subsidiary of Adams Rite Manufacturing Co.

2. 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. Ives, an Allegion company
b. Hager Companies
c. McKinney Products Company; an ASSA ABLOY Group company
d. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

3. Provide electric power transfer where required and coordinate installation with electrical and security work.

2.6 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; with strike that suits frame and handle that retracts latchbolt. Provide compatible power supply and electric power transfer and coordinate installation with electrical work.

1. Basis-of-Design Product:

a. Schlage Commercial Lock Division; an Allegion company; **L Series-Wired – Sparta, Vandlgard** functions

2. 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. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company
b. Folger Adam Electric Door Controls; an ASSA ABLOY Group company
c. HES, an ASSA ABLOY Group company
d. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

3. Type: Mortise latchbolt.

2.7 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Basis-of-Design Product:

a. Von Duprin; an Allegion company; **Series 99L** and **9927L(-F)**, **996/06** trim

2. 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. Dormakaba Group
b. SARGENT Manufacturing Company; an ASSA ABLOY Group company
c. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Coordinate exit device operation with cylinder locks where specified.

C. Interior panic hardware shall be cut ½ width of door from latch side only.

D. All exit devices shall be provided with cylinder dogging hardware for manual keying.

E. Vertical rod exit devices shall be less bottom rod (**LBR**).

F. At paired exit device doors where indicated, provide keyed removable mullions similar to Von Duprin steel mullion, **Model #9954**.

G. Provide electric latch retraction (**-EL**), power supply (**PS900 Series**), and electric power transfer (**EPT-2**) where required for electrified exit devices.

2.8 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless-steel, or nickel silver.

1. Manufacturer: Same manufacturer as for keying.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are removable; face finished to match lockset.

2.9 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Incorporate decisions made in keying conference.

1. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders to match existing keying system.

B. Keys: Brass.

1. Quantity: In addition to one (1) extra key blank for each lock, provide the following:

a. Great-Grand Master Keys: Five (5).

J. Door closers are to be mounted on the least conspicuous side of the door. The hardware supplier shall consult with the Architect to verify applications and note mounting locations on the hardware schedule.

2.10 CLOSER HOLDER RELEASE DEVICES

A. Closer Holder Release Devices: ANSI/BHMA A156.15, Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door must become self-closing on interruption of signal to release device. Automatic release is activated by smoke detection system.

1. Basis-of-Design Product:

a. Dormakaba Group; **1800 Series**

2. 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. LCN, an Allegion company
b. SARGENT Manufacturing Company, an ASSA ABLOY Group company
c. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

3. Type: Single-point hold-open.
4. Features:

a. Adjustable backcheck.
b. Integral smoke detector.
c. Adjustable spring power.
d. Adjustable hold-open manual release force.

5. Devices are to be mounted on the least conspicuous side of the door. The hardware supplier shall consult with the Architect to verify applications and note mounting locations on the hardware schedule.

2.11 POWER OPERATOR

A. Low-Energy Power Operator: BHMA A156.19; swing door operator with built-in on/off/hold toggle switch. Provide with two (2) wall mounted 4½-inch-square "Push to Open" paddles and switches,

as indicated by Architect, mounted as required by the ADA. Coordinate installation with electrical and security work.

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. Dormakaba Group
    b. Horton Automatics
    c. LCN; an Allegion company
    d. NABCO Entrances Inc.
    e. Norton Door Controls, an ASSA ABLOY Group
    f. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Performance Requirements:

1. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
2. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
3. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

2.12 POWER-ASSIST OPERATOR

A. Low-Energy Power-Assist Operator: BHMA A156.19; power-assisted opening that reduces force to open door and spring closing. Pushing or pulling on door activates operator. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

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. Dormakaba Group
    b. LCN; an Allegion company
    c. Norton Door Controls, an ASSA ABLOY Group
    d. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Performance Requirements:

1. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
2. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
3. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

2.13 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

1. Basis-of-Design:

a. IVES Hardware, an Allegion company; **407** and **436** or **438**

1) Provide wall bumpers wherever possible. Provide floor stops where the use of wall bumpers is not feasible, provided the location of the stop is not a stumbling hazard or would cause the door to rack at the hinges.

2. 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. Burns Manufacturing Incorporated
b. Rockwood Manufacturing Company, an ASSA ABLOY Group company
c. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.14 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Basis-of-Design Product:

a. Glynn-Johnson, an Allegion company; **90 Series**

2. 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. Architectural Builders Hardware Mfg., Inc.
b. Rockwood Manufacturing Company, an ASSA ABLOY Group company
c. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.15 SMOKE SEALS

A. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke ratings indicated, based on testing according to UL 1784.

1. Basis-of-Design Products:

a. Pemko Manufacturing Co., an ASSA ABLOY Group company

1) Smoke Rated Doors:

a) Head and Jamb: **S88C**, compression bulb
b) Meeting Stiles: **S771x6**
c) Sill: **411APKL**, automatic door bottom

2) Fire Rated Doors: Provided by the door manufacturer.

2. 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. Reese Enterprises, Inc.
b. Zero International, an Allegion company
c. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.16 WEATHERSTRIPPING

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. Basis-of-Design Product:

a. Pemko Manufacturing Co., an ASSA ABLOY Group company

1) Head and Jamb: **#328AA**, solid neoprene in an extruded aluminum housing.

2. 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. National Guard Products
b. Zero International, an Allegion company
c. Substitutions: In accordance with Section 012500 “Substitution Procedures”.

B. Automatic Door Bottoms: Nylon brush gasket material held in place by housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

1. Basis-of-Design Product:

a. Pemko Manufacturing Co., an ASSA ABLOY Group company; **411APKL**

2. 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. National Guard Products
b. Zero International, an Allegion company
c. Substitutions: In accordance with Section 012500 “Substitution Procedures”.

3. Housing Material: Aluminum.
4. Mounting: Mortised into bottom of door.
5. Type: Low-closing-force type for doors required to meet accessibility requirements.

2.17 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless-steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Basis-of-Design Product:

a. Burns Manufacturing Incorporated

2. 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. IVES Hardware, an Allegion company

b. Rockwood Manufacturing Company, an ASSA ABLOY Group company
c. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

3. All plates are 2 inches less width of door on single doors, 1-inch less width of door on pairs.

a. Kick Plates: 16 inches high.

2.18 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

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. Hager Companies
b. Rockwood Manufacturing Company, an ASSA ABLOY Group company
c. Stanley Commercial Hardware, a division of Dormakaba
d. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.19 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

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. GE Security, Inc.
b. SARGENT Manufacturing Company, an ASSA ABLOY Group company
c. Schlage Commercial Lock Division, an Allegion company
d. Security Door Controls
e. Substitutions: Under provision of Section 012500 “Substitution Procedures”.

2.20 FABRICATION

A. Base Metals: Produce door hardware units of base metal 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.

B. 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. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames.

2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Surface-mounted exit devices.

c. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

3. All closers to be installed using through bolting.

2.21 FINISHES

A. Provide finishes complying with BHMA A156.18. Unless otherwise specified in the hardware sets or specification, materials and finishes for the buildings shall be as follows:

1. BHMA 626 or 630.

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. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. 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 work. 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 (1) 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 removable cores as indicated in keying schedule.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

F. Stops: Provide wall or floor stops for doors unless 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.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

H. Door Bottoms: Apply to bottom of door, forming seal with threshold/saddle/floor when door is closed.

3.4 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. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 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.

3.6 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.

B. Maintenance Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

3.7 DOOR HARDWARE SCHEDULE

A. Provide hardware as specified in the previous articles in sets according to the following schedule and as indicated in the Door Schedule on the Drawings.

B. The hardware supplier shall meet with the Architect and/or Owner to determine lock functions and keying requirements.

HW-1

EACH TO HAVE:

	CONTINUOUS HINGES
2	ELEC. EXIT DEVICES (STORERM)
1	REMOVABLE MULLION
1	POWER OPERATOR
1	POWER ASSIST
2	OH STOPS
2	KICK PLATES
	WEATHERSTRIPPING
	ACCESS CONTROL

DOOR: 01A

HW-2

EACH TO HAVE:

	CONTINUOUS HINGES
2	ELEC. EXIT DEVICES (STORERM)
1	REMOVABLE MULLION
2	POWER ASSISTS
2	OH STOPS
2	KICK PLATES
	WEATHERSTRIPPING

DOOR: 01B, 01C

HW-3

EACH TO HAVE:

	CONTINUOUS HINGES
1	ELEC. STOREROOM LOCKSET
1	POWER OPERATOR
1	STOP
1	KICK PLATE
	SMOKE SEALS

DOOR: 01D

HW-4

EACH TO HAVE:

	BUTTS
1	EXIT DEVICE (PASSAGE)
1	CLOSER HOLDER RELEASE
1	KICK PLATE
	SMOKE SEALS

DOOR: 02C

HW-5

EACH TO HAVE:
- BUTTS
- 2 VR EXIT DEVICES (PASSAGE)
- 2 CLOSER HOLDER RELEASES
- 2 KICK PLATES
- SMOKE SEALS

DOOR: 02A, 02B

HW-6

EACH TO HAVE:
- 1 POWER OPERATOR
- BALANCE OF HDWR TO REMAIN

DOOR: 00A

HW-7

EACH TO HAVE:
- 1 ELEC. STOREROOM LOCKSET
- 1 POWER OPERATOR
- ACCESS CONTROL
- BALANCE OF HDWR TO REMAIN

DOOR: 20A

END OF SECTION 087100

SECTION 088000 - GLAZING

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. Glass for doors and frames.
2. Glazing sealants and accessories.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations according to ASTM C 1036.

C. IBC: International Building Code.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Accessory Samples: For gaskets and sealants, in 12-inch lengths. Install sealant Samples between two (2) strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers, glass testing agency and sealant testing agency.

B. Product Test Reports: For tinted glass, coated glass, insulating glass, glazing sealants, and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Pre-construction adhesion and compatibility test report.

D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.8 PRE-CONSTRUCTION TESTING

A. Pre-construction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight (8) Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage

or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Cardinal Glass Industries
2. DuPont™ Building Innovations
3. McGrory Glass, Inc.
4. Oldcastle BuildingEnvelope
5. PPG Industries, Inc.
6. Viracon, Inc.
7. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings and per Building Code, whichever is most stringent.
2. Maximum Lateral Deflection: For glass supported on all four (4) edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1-inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA’s "Laminated Glazing Reference Manual" and GANA’s "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

D. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.5 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 butyl interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one (1) of the following:

1. EPDM complying with ASTM C 864.
2. Silicone complying with ASTM C 1115.
3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect and Owner from manufacturer's full range, to match adjacent framing.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

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. Dow Corning Corporation; **790**
b. Pecora Corporation; **890**

c. Tremco Incorporated; **Spectrem 1**
d. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, one hundred percent (100%) solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one (1) continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove non-permanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC-GLASS SCHEDULE

A. Glass Type **GL-1**: Not used.

B. Glass Type **GL-2**: Clear fully tempered float glass.

1. Thickness: ¼-inch.
2. Safety glazing required.

C. Glass Type **GL-3**: Not used.

D. Glass Type **GL-4**: Not used.

3.9 LAMINATED GLASS SCHEDULE

A. Glass Type **GL-5**: Not used.

B. Glass Type **GL-7**: Not used.

1. Ballistic Resistance: **Level 4** according to UL 752.
2. Maximum Overall Unit Thickness: 1-inch.
3. Provide safety glazing labeling.
4. Polycarbonate material is not acceptable.

C. Glass Type **GL-22**: Not used.

D. Glass Type **GL-46**: Not used.

E. Glass Type **GL-48**: Not used.

3.10 INSULATING-GLASS SCHEDULE

A. Glass Type **GL-9**: Not used.

B. Glass Type **GL-10**: Not used.

C. Glass Type **GL-11**: Not used.

D. Glass Type **GL-12**: Not used.

E. Glass Type **GL-13**: Not used.

F. Glass Type **GL-14**: Not used.

G. Glass Type **GL-15**: Not used.

H. Glass Type **GL-16**: Not used.

I. Glass Type **GL-18**: Not used.

J. Glass Type **GL-20**: Not used.

K. Glass Type **GL-25**: Not used.

L. Glass Type **GL-26**: Not used.

M. Glass Type **GL-32**: Not used.

N. Glass Type **GL-36**: Not used.

O. Glass Type **GL-42**: Not used.

P. Glass Type **GL-43**: Not used.

3.11 INSULATING-LAMINATED-GLASS TYPES

A. Glass Type **GL-17**: Not used.

B. Glass Type **GL-19**: Not used.

C. Glass Type **GL-21**: Not used.

D. Glass Type **GL-23**: Not used.

E. Glass Type **GL-27**: Not used.

F. Glass Type **GL-28**: Not used.

G. Glass Type **GL-29**: Not used.

H. Glass Type **GL-30**: Not used.

I. Glass Type **GL-31**: Not used.

J. Glass Type **GL-41**: Not used.

3.12 FIRE-RESISTANCE-RATED GLAZING TYPES

A. Glass Type **GL-6**: Not used.

B. Glass Type **GL-8**: Not used.

C. Glass Type **GL-24**: Not used.

D. Glass Type **GL-33**: Not used.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing for interior partitions.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

B. Maximum Assembly Deflection = L/360 with 7.5psf.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653, G60, hot-dip galvanized.

B. Studs and Tracks: ASTM C 645.

1. Steel Studs and Tracks:

a. Minimum Base-Metal Thickness: 20-gauge (33-mil), unless noted otherwise.
b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) ClarkDietrich; **MaxTrak Slotted Deflection Track**
2) MarinoWare; **Slotted Track**
3) MBA Building Supplies; **Slotted Deflecto Track**
4) Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.018-inch.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one (1) of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8-inch-thick, in width to suit steel stud size.

C. Rigid Connections: Universal framing clip to attach and support rigid framing conditions including shear, tension, and two-axis loading.

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. Dietrich Metal Framing; **Uni-Clip**
b. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames.

    a. Install two (2) studs at each jamb unless otherwise indicated.
    b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8-inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

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 gypsum board.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

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. Georgia-Pacific Gypsum LLC
2. National Gypsum Company
3. USG Corporation
4. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Abuse-Resistant Gypsum Board: ASTM C 1629.

1. Core: Regular, unless otherwise indicated on Drawings.
2. Surface Abrasion: Meets or exceeds Level 3 requirements.
3. Surface Indentation: Meets or exceeds Level 1 requirements.
4. Single-Drop Soft-Body Impact: Meets or exceeds Level 1 requirements.
5. Long Edges: Tapered.
6. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
7. All gypsum board to be abuse-resistant unless otherwise noted.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Pre-filling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033- to 0.112-inch-thick.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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. Pecora Corporation; **AC-20 FTR**
b. Specified Technologies, Inc.; **Smoke N Sound Acoustical Sealant**
c. USG Corporation; **SHEETROCK Acoustical Sealant**
d. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one (1) framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow ¼- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide ¼- to ½-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets and boards before installing gypsum panels unless blankets and boards are readily installed after panels have been installed on one (1) side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels in most economical direction, with ends and edges occurring over firm bearing unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one (1) framing member in alternate courses of panels.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. Bullnose Bead: Use at outside corners.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Pre-fill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 4: At panel surfaces that will be exposed to view, receiving wallcoverings and flat and non-flat paints.

    a. Primer and its application to surfaces are specified in Division 09 Sections.

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

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, 6 inches in size.

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. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to two percent (2%) of each type of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to two percent (2%) of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15¾ inches away from test surface according to ASTM E 795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANEL MANUFACTURERS

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. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Decoustics
4. USG Interiors, Inc., Subsidiary of USG Corporation
5. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.4 ACOUSTICAL PANELS

A. Basis-of-Design Product (**ACT**):

1. Armstrong World Industries, Inc.; **Calla**
2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

   a. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face, back, and sealed edges.
   b. Pattern: E (lightly textured).

3. Color: White.
4. LR: Not less than 0.86.
5. NRC: Not less than 0.85.
6. Edge/Joint Detail: Square tegular.
7. Thickness: 1-inch.
8. Modular Size: 24 by 24 inches.

B. Broad Spectrum Anti-microbial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard anti-microbial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEM

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. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Decoustics
4. USG Interiors, Inc.; Subsidiary of USG Corporation
5. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Wide-Face, Double-Web, Hot-Dip Galvanized, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653; with pre-finished, cold-rolled, 15/16-inch-wide flanges.

1. Basis-of-Design Product:

a. Armstrong World Industries, Inc.; **Prelude XL 15/16-Inch Exposed Tee System**

2. Structural Classification: Heavy-duty system.
3. Face Design: Flat, flush.
4. Finish: Painted white.

2.6 ACCESSORIES

A. Attachment Devices: Size for five (5) times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Provide manufacturer’s standard fasteners and hooks.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three (3) times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

C. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.7 METAL EDGE MOLDINGS AND TRIM

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. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. USG Interiors, Inc.; Subsidiary of USG Corporation
4. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Roll-Formed, Sheet-Metal Edge Moldings: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.8 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; **AC-20 FTR Acoustical and Insulation Sealant**
b. USG Corporation; **SHEETROCK Acoustical Sealant**
c. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Non-sag, paintable, non-staining latex sealant.
2. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three (3) tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four (4) tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8-inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND 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. Resilient base.

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, not less than 12 inches long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 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 not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 WARRANTY

A. Provide manufacturer's written limited warranties against defects in materials and against premature wear prior to warranty expiration for the materials as follows:

1. Resilient Base: Two (2) years.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Conform to Class I rating with a flame spread of 0 to 25 in accordance with the requirements of Class A material in accordance with ASTM E 84. Rubber products shall be Class I, 0.45 watts/sq. cm in accordance with ASTM E 648 and NFPA 255.

2.2 THERMOPLASTIC-RUBBER BASE

A. Basis-of-Design (as a minimum, but to match existing):

1. Johnsonite; A Tarkett Company; **Duracove**

B. 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. Burke Mercer Flooring Products, Division of Burke Industries Inc.
2. Flexco Corporation
3. Mannington Mills, Inc.
4. Roppe Corporation, USA
5. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

C. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style: B, Cove.

D. Thickness: 0.125-inch, unless otherwise noted.

E. Height: 4 inches, but to match existing.

F. Lengths: Coils in manufacturer's standard length.

G. Outside and Inside Corners: Pre-formed.

H. Colors: As selected by Architect and Owner from manufacturer’s entire range, but to match existing.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Pre-formed Corners: Install pre-formed corners before installing straight pieces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:

1. Concrete masonry units (CMU).
2. Steel and iron.
3. Galvanized metal.
4. Gypsum board.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 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. Paint: Five percent (5%), but not less than 1 gallon of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds eighty-five percent (85%); at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Benjamin Moore & Co.
2. ICI Paints
3. PPG Industries, Inc.
4. Sherwin-Williams Company (The)
5. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system 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.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Non-Flat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anti-corrosive and Anti-rust Paints Applied to Ferrous Metals: 250 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

D. Colors: As selected by Architect and Owner from manufacturer's entire range, to match existing where required.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two (2) paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (Clay and CMUs): Twelve percent (12%).
2. Gypsum Board: Twelve percent (12%).

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 3, "Power Tool Cleaning."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms, unless factory-finished:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Pipe hangers and supports.
d. Metal conduit.
e. Tanks that do not have factory-applied final finishes.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces, unless factory-finished:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Pipe hangers and supports.
d. Metal conduit.
e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
f. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Latex System:

a. Block Filler: Block filler, latex, interior/exterior, **MPI #4**.
b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, eggshell, (Gloss Level 3), **MPI #52**.

B. Steel Substrates:

1. Latex System, Alkyd Primer:

a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76**.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (Gloss Level 5), **MPI #54**, as a minimum, but to match existing.

C. Galvanized-Metal Substrates:

1. Latex System:

a. Prime Coat: Primer, galvanized, water based, **MPI #134**.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (Gloss Level 5), **MPI #54**, as a minimum, but to match existing.

D. Gypsum Board/Plaster Substrates:

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior, **MPI #50**.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat, (Gloss Level 1), **MPI #53**, at ceilings.
d. Topcoat: Latex, interior, eggshell, (Gloss Level 3), **MPI #52**, as a minimum, but to match existing.

END OF SECTION 099123

SECTION 099647 - INTUMESCENT PAINTING

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. Intumescent paint for interior items and surfaces.

B. Related Requirements:

1. Section 099123 "Interior Painting" for primers and finish coats that may be used with intumescent paint finishes.

1.3 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples: For each type of coating system and each color and gloss of intumescent paint finish indicated.

1. Submit Samples on rigid backing, not less than 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each intumescent paint.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are from same production run (batch mix) as materials applied and that are packaged with protective covering for storage and identified with labels describing contents.

1. Quantity: Furnish an additional five percent (5%) of each color applied, but not less than 1 gallon of each material and color applied.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply waterborne intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F.

B. Do not apply intumescent paints in snow, rain, fog, or mist; when relative humidity exceeds eighty-five percent (85%); at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Allow wet surfaces to dry thoroughly and to attain temperature and conditions specified before starting or continuing coating operation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Benjamin Moore
2. FlameOFF Coatings, Inc.
3. LRBG Chemicals, Inc.
4. PPG Architectural
5. Protek Paint Ltd.
6. Sherwin-Williams Company (The)
7. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.2 INTUMESCENT PAINT

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Surface-Burning Characteristics of Fire-Retardant Systems: As tested according to ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each material or coat, products and spreading rates shall be as recommended in writing by intumescent paint manufacturer for use on substrate indicated. Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.

D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.

E. Colors and Gloss: As selected by Architect and Owner from manufacturer's entire range, to match existing where required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for surface treatments, shop-primed surfaces, maximum moisture content, and other conditions affecting performance of the Work.

B. Begin coating only when moisture content of wood substrate is fifteen percent (15%) or less when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions, and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in the "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed 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, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if surface moisture content or alkalinity exceeds that permitted in manufacturer's written instructions.

1. Remove incompatible primers, and reprime substrate with compatible primers as required to produce coating systems indicated.
2. Perform cleaning and coating application so dust and other contaminants from cleaning process do not fall on wet, newly coated surfaces.

3.3 INSTALLATION

A. Apply intumescent paints according to manufacturer's written instructions and to comply with requirements for listing and labeling for surface-burning characteristics specified.

1. Use equipment and techniques best suited for substrate and type of material being applied.
2. Coat surfaces behind movable items the same as similar exposed surfaces.
3. Apply each coat separately according to manufacturer's written instructions.

B. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

1. Pigmented Finishes: If undercoats or other conditions show through pigmented topcoat/overcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 INTERIOR INTUMESCENT PAINTING SCHEDULE

A. Wood Substrates:

1. Pigmented, Fire-Retardant, Water-Based System**, MPI INT 6.3R**:

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat:

1) Fire-retardant topcoat, latex, interior, **MPI #67**.

END OF SECTION 099647

SECTION 101400 - SIGNAGE

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. Panel signs.

B. Related Sections include the following:

1. Section 015000 "Temporary Facilities and Controls" for temporary information and directional signs.
2. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
3. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
4. Section 265219 "Emergency and Exit Lighting" for illuminated Exit signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign.

C. Samples: Manufacturer’s color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Acrylic Sheet: Full-size Sample for each color required.

D. Sign Schedule: Use same designations indicated on Drawings or as listed in special schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image
c. Separation or delamination of sheet material and components.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC/ANSI A117.1.

C. Source Limitations for Signs: Obtain each sign type indicated from one (1) source from a single manufacturer.

2.2 PANEL SIGNS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. ASE, Inc.
2. Best Sign Systems, Inc.
3. Intelligent Signage, Inc.
4. Seton Identification Products
5. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16-inch measured diagonally from corner to corner.

C. Interior Signs: Provide matte finish plaques in sizes to accommodate the message indicated in the Construction Documents. Fabricate of thermoformed acrylic plastic conforming to ASTM D 709, Type NDP minimum 1/8-inch. Provide with square corners.

1. Graphics Application:

a. Raised Letters: Minimum 1/32-inch-thick acrylic message letters. These shall comply with Section 703.2.3 (not italic, oblique, script or decorative) and 703.2.5 (1-inch character height) of the ICC/ANSI A117.1 Code.
b. Pictogram: Each sign shall be provided with an international symbol of accessibility per Section 4.30.7 (Figure 43 a and b) of the Americans with Disabilities Act. The raised image pictogram shall have a field height of 6 inches minimum. Text and braille shall NOT be located in the pictogram field.
c. Messages:

1) Typeface: Helvetica Medium, with accompanying Grade 2 Braille message.
2) Type Size: 1-inch large and small case, with width, height and stroke complying with the requirements of Section 703.2.6 (maximum stroke width fifteen percent (15%) of the height of each letter at the top surface of the character and thirty percent (30%) maximum of the height of each letter at the base, Section 703.2.7 (character spacing 1/8-inch minimum and four (4) times the tactile character stroke width maximum), and Section 703.2.8 (spacing between lines shall be between one hundred thirty-five percent (135%) and one hundred seventy percent (170%) of the tactile character height) of the ICC/ANSI A117.1 Code.
3) Background Color: In color selected by Architect and Owner from manufacturer's entire range, to match existing. Message Color: In contrasting color of background.

2.3 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.4 ACCESSORIES

A. Adhesive: As recommended by sign manufacturer.

1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Pre-assemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to tight, hairline fit. Form assemblies and joints exposed to weather to exclude water penetration and retention.
3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.6 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: 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.

2.7 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five (5) years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.

1. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

C. Mounting Methods:

1. Silicone-Adhesive Mounting: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign and two-face tape.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102641 - BULLET-RESISTANT PANELS

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 bullet-resistant fiberglass panels.

B. Related Requirements:

1. Section 083950 “Bullet-Resistant Steel Doors and Frames” for doors and frames that support bullet-resistant panels.
2. Section 092216 “Non-Structural Metal Framing” for non-structural framing that support bullet-resistant panels.

1.3 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions, impact strength, and manufacturer’s recommended installation instructions.

B. Shop Drawings: Details of installation of bullet-resistant fiberglass panels.

C. Samples: Two (2), minimum 6 by 6 inches square, representing actual product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualifications: For Manufacturer and Installer.

B. Product Certificates: Provide to indicate compliance with the following:

1. UL Listing Verification and UL752 Current Test Results as provided by Underwriters Laboratories.
2. ASTM F 1233 Standard Test Method for Forced Entry Testing of Materials/Assemblies.
3. Manufacturer’s third-party certificate of registration with ISO 9001:2008.

C. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum five (5) years experience manufacturing similar products.

B. Installer Qualifications: Minimum two (2) years experience installing similar products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Deliver materials to project site with manufacturer’s UL Listed labels intact and legible.

C. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within the limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s recommended limits.

1.9 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace bullet-resistant fiberglass panels that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Armortex
2. Covenant Security Equipment
3. Fortified Estate, LLC
4. Insulgard Security Products
5. Total Security Solutions, Inc.
6. Waco Composites
7. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

2.2 PERFORMANCE REQUIREMENTS

A. Bullet Resistant Fiberglass Panels shall be “non-ricochet type” to permit the capture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.

1. Panel Rating: UL752 **Level 4**.
2. Bullet Resistance of Joints: Equal to that of the panel.

2.3 BULLET-RESISTANT PANELS

A. Panels: Multiple layers of woven roving ballistic-grade fiberglass cloth impregnated with thermoset polyester resin and compressed into flat rigid sheet.

1. Thickness: As indicated on Drawings.
2. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 ACCESSORIES:

A. Adhesives and Fasteners: Type recommended by manufacturer for specific application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Do not begin installation until substrates have been properly prepared.

C. Verify work of related trades required in contract documents and architectural drawings is complete to the point where work of this Section may properly commence.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best results for the substrate under the project conditions.

3.3 INSTALLATION

A. Install panels in accordance with manufacturer’s recommendations and in proper relationship with adjacent construction.

B. Reinforce joints with a back-up layer of bullet-resistive material. Minimum width of reinforcing layer at joint shall be 4 inches, centered on panel joints.

C. Secure panels using screws, bolts, or an industrial adhesive.

1. Cut panels to fit at perimeter and around penetrations.
2. Method of application shall install panels minimizing vulnerabilities by fitting tightly to adjacent surfaces including but not limiting to floor substrates, roof deck, door and window frames, and the like.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 102641

SECTION 230000 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Basic Mechanical Requirements specifically applicable to Division 23 Sections in addition to Division 01 General Requirements.

1.2 INTENT

A. It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation. All materials, equipment, and apparatus shall be new and of first-class quality.

B. Any apparatus, appliance, material, or work not shown on Drawings, but mentioned in the Specifications, or vice versa, or any incidental accessories or minor details not shown, but necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be provided by the Contractor without additional expense to the Owner.

C. With submission of bid, the Contractor shall give notice to the Engineer of any materials, apparatus, or omissions believed to be in violation of laws, ordinances, rules or regulations, or authorities having jurisdiction. In the absence of such written notice, it is mutually agreed that the Contractor shall include the cost of providing all systems in accordance with applicable regulations without extra compensation.

1.3 SUBMITTALS

A. Submit under provisions of Division 01 Sections.

B. Include products as required by individual Sections.

C. Submit Shop Drawings and Product Data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

D. Mark dimensions and values in units to match those specified.

E. Submit plan indicating measures being taken to maintain indoor air quality of occupied portion of building during construction.

1.4 DRAWINGS AND COORDINATION

A. Drawings are schematic in nature and do not indicate every item, piece of equipment, and detail. Provide complete, operating systems.

B. Install work as closely as possible to layouts shown on Drawings. Modify work as necessary to meet job conditions and to clear other equipment. Consult Architect before making changes which affect the function or appearance of systems.

C. Dimensions, elevations, and locations are shown approximately. Verify dimensions in field.

D. Architect reserves the right to order changes in layout of such items as piping, ducts, and equipment if such changes do not substantially affect costs and if affected items have not been fabricated or installed.

E. In some cases, Drawings are based on products of one (1) or several manufacturers, as listed on Contract Documents. Contractor shall be responsible for modifications made necessary by substitution of products of other manufacturers. Modifications may be required in electrical distribution materials and components, structural supports, concrete pads, gas piping, breeching and chimneys, etc.

F. Do not install part of a system until all critical components of the system and related systems have been approved. Coordinate parts of systems.

G. Coordinate work with work specified in other Sections. Relocate work if required for proper installation and functioning of other systems.

H. Install products in accordance with manufacturer's instructions. Notify Architect if Contract Documents conflict with manufacturer's instructions. Comply with Architect's interpretations.

I. Provide brackets, supports, anchors, and frames required for installation of work specified in this division. Such metal work shall conform to the requirements of Section 055000 “Metal Fabrications”.

J. Where Contract Documents provide conflicting information, Contractor shall be responsible for design having highest cost.

1.5 PROJECT RECORD DRAWINGS

A. Prepare project Record Drawings of mechanical systems in conformance with the requirements of the General Conditions and Division 01 Sections.

1.6 INDOOR AIR QUALITY

A. Provide measures to maintain minimum standard for indoor air quality in accordance with SMACNA guidelines, by preventing air contaminated by demolition and construction activities from being transferred to occupied portions of building when work includes renovation, addition, or alteration to building occupied during demolition/construction.

B. Measures shall include but not be limited to the following:

1. Air filtration.
2. Temporarily sealing ductwork, air inlets and outlets, and ventilation openings to prevent transfer of contaminated air.
3. Installation of bypass ducts or openings and additional temporary system modifications as required to prevent cross contamination, and to maintain proper system operation during construction.

C. Submit plan of cross contamination control measures in accordance with SMACNA guidelines prior to beginning construction.

1.7 PRELIMINARY OPERATION

A. Operate mechanical systems with required supervision for at least two (2) full days prior to substantial completion. Make necessary adjustments and check proper operation.

1.8 TESTS PRIOR TO SUBSTANTIAL COMPLETION

A. Tests shall be attended by representatives of mechanical subcontractors, equipped with instruments required to demonstrate proper functioning of systems, as specified. Demonstrate the following:

1. Equipment installed and operating in accordance with the manufacturer's specifications and instructions and with these specifications.
2. Safety and temperature controls operating as specified.
3. Systems properly flushed, cleaned, and free of contaminants.
4. Systems properly balanced.
5. Motors equipped with proper overload protection and not operating under overload. Obtain ammeter readings.
6. Instruments recording properly.
7. Submit report listing system tested, date, results, and description of fault corrections, if any.

1.9 WARRANTY

A. Except as provided in individual Specification Sections, subcontractors shall provide a One (1) Year Labor & Material Warranty that all materials and equipment furnished shall be new and of good quality, free from faults and defects, and in conformance with the Contract Documents. Any defects due to faulty workmanship or materials which appear during the first year shall be corrected by the subcontractor at no additional cost to the Owner. The Warranty will be the responsibility of the subcontractor for a period of one (1) year from the date of Substantial Completion for that particular building area as the construction phases are completed.

B. For all major pieces of equipment, the Warranty will commence after the equipment has been put into permanent operating mode, equipment and components have been commissioned and accepted by the Commissioning Agent, and the Operating & Maintenance Manuals have been submitted and approved.

C. The subcontractor shall include in the Base Bid the cost of providing routine maintenance services as documented by manufacturer’s operating and maintenance literature. Subcontractor shall be responsible for the manufacturer’s recommended maintenance procedures for a period of one (1) year from the time the Warranty commences or until completion of the entire construction project, whichever is later.

D. Submit written warranty of warranties covering work specified in Division 23.

1.10 OPERATING AND MAINTENANCE MANUALS

A. Submit Operating and Maintenance manuals in accordance with this Section and Division 01 Sections.

B. Include operating and maintenance instructions for equipment where applicable.

C. List replacement parts and order procedure.

D. Include lubrication instructions and schedule, with types of lubricant to be used.

E. Instruct Owner's personnel in use of equipment specified in this Division.

1.11 REGULATORY REQUIREMENTS

A. Conform to applicable provisions of the 2022 Connecticut Basic Building Code which include the following:

1. 2021 International Building Code
2. 2021 International Mechanical Code
3. 2021 International Plumbing Code

B. Amendments, alterations, deletions, and addition of certain provisions to the above as indicated in Connecticut Supplements.

C. All work will conform to applicable provisions of Connecticut Public Health Code.

D. Indoor air quality during construction will be maintained in accordance with SMACNA IAQ Guidelines for Occupied Buildings under Construction.

E. All work will also conform to applicable provisions of the Connecticut Fire Safety Code.

F. Work of this project shall be barrier free and will conform to the Americans with Disabilities Act (ADA), ICC/ANSI 117.1, 2003 and Uniform Federal Accessibility Standards (UFAS).

G. New construction and renovation work will comply with the requirements of the 2015 International Energy Conservation Code.

H. Conform to applicable Town of Greenwich requirements.

I. Obtain and pay for permits and inspections from authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230000

SECTION 230100 - MECHANICAL 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. This Section includes the following:

1. Demolition involving mechanical systems as described in Contract Documents.

1.3 SCHEDULING

A. Include on Construction Schedule sequence of individual electrical demolition operations.

B. Coordinate with Owner for equipment and materials to be removed by Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to Owner.

3.2 PREPARATION

A. Disconnect equipment that is to be removed or relocated. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work.

B. Verify electrical power secured off at panel prior to commencing demolition of electrically powered equipment.

C. Where affected by demolition or new construction, relocate, extend, or repair ductwork and piping to allow continued use of mechanical systems. Use methods and materials as specified for new construction.

D. Mechanical contractor shall be responsible for cutting, capping, and repairing mechanical systems. Mechanical contractor shall cut and make safe all systems being modified or removed. Demolition contractor shall remove and dispose of systems.

E. Reclaim refrigerant from HVAC systems prior to commencing demolition.

F. Systems designated for removal shall be removed in their entirety, including but not limited to, all ductwork, piping, hangers, supports, controls, and wiring.

3.3 PERFORMANCE

A. Perform drilling, cutting, block-offs and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from Architect.

B. Patch, repair, and finish surfaces affected by mechanical demolition work, unless work is specifically called for under other Sections of the specifications.

C. Remove electrical disconnect switches and control panels serving mechanical equipment being removed. Remove conductors back to panel. Coordinate removal of electrical devices with electrical contractor.

D. All equipment and materials designated for removal shall be removed from site and disposed of in a legal manner.

E. Provide temporary caps for piping and ductwork as required to seal and prevent introduction of foreign materials into systems remaining.

3.4 CLEANING

A. Remove obsolete equipment, piping, hangers, supports, and misc. promptly from site and dispose of legally.

END OF SECTION 230100

SECTION 230500 - COMMON WORK RESULTS 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. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Stack sleeve fittings.
7. Escutcheons.
8. Grout.
9. Mechanical demolition.
10. Equipment installation requirements common to equipment sections.
11. Painting and finishing.
12. Concrete bases.
13. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code-Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, non-metallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8-inch-thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one (1) end with threaded brass insert and one (1) solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one (1) end with threaded brass insert and one (1) solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

2.5 DIELECTRIC FITTINGS

A. Description: Combination of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Eclipse, Inc.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Epco Sales, Inc.
c. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Capitol Manufacturing Co.
    d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

    a. Calpico, Inc.
    b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

    a. Perfection Corp.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Link Seal System
    d. Metraflex Co.
    e. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic. Include two (2) for each sealing element.
4. Connecting Bolts and Nuts: Stainless-steel of length required to secure pressure plates to sealing elements. Include one (1) for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

B. Galvanized-Steel Wall Pipes: ASTM A 53, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 80.

2.8 STACK SLEEVE FITTINGS

A. Manufacturers:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group

B. Description: Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.9 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.10 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Pre-mixed and factory packaged.

PART 3 - EXECUTION

3.1 COMMISSIONING OF SYSTEMS AND EQUIPMENT

A. Engage a factory-authorized service representative or technician who is familiar with this project to participate and assist, if necessary, in the functional performance testing of the equipment include in this Division with the Commissioning Agent.

3.2 MECHANICAL DEMOLITION

A. Refer to Sections 017300 "Execution" and 024119 "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same material.
2. Ducts to Be Removed: Remove portion of ducts indicated to be removed and pug remaining duct with same ductwork material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality. Where affected by demolition or new construction, relocate, extend, or repair ductwork and piping to allow continued use of mechanical systems. Use methods and materials as specified for new construction.

D. Remove obsolete piping, ductwork, hangers, miscellaneous equipment promptly from site and dispose of legally.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. 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.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. 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 with spring clips.
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 Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. 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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide ¼-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Section 079200 "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section 078413 "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846 Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Non-Pressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-Pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.7 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.11 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 230500

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. 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.

D. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

    a. Flex-Strut Inc.
    b. GS Metals Corp.
    c. Unistrut Corporation; Tyco International, Ltd.
    d. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

    a. Anvil International; a subsidiary of Mueller Water Products Inc.
    b. Empire Industries, Inc.
    c. ERICO International Corporation

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services
3. ERICO International Corporation
4. National Pipe Hanger Corporation
5. PHS Industries, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 ROOF PIPE SUPPORTS

A. Manufacturer

1. Miro Industries, Inc.
2. Substitutions: Under provisions of Section 012500 “Substitution Procedures”.

B. General Requirements for Pipe Stands:

1. Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
2. Support foot and foot pad shall be of sufficient size to limit load transmitted to roof insulation and membrane below manufacturer’s maximum allowable load.

C. 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. Provide support pad between support and roofing membrane.

D. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration. Provide support pad between support and roofing membrane.

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 (1) or more; plastic, with support pad.
3. Vertical Members: Two (2) or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

B. Rooftop Condensing Unit Supports:

1. **Big Foot Stands** by RectorSeal or similar product by alternate manufacturer subject to approval of Engineer.
2. Tubular galvanized steel adjustable support stand with 8-inch nylon footings, leveling adjustment, and adjustable framework to match equipment support points.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, non-corrosive, and non-gaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Install factory supports in accordance with manufacturer’s installation instructions.

B. 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.

C. Provide curb mounted pipe supports where pipe support curbs are indicated.

D. 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, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

E. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. 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.

H. 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.

I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. 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.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) 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.

N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. 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.

P. 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.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches long and 0.048-inch-thick.
    b. NPS 4 (DN 100): 12 inches long and 0.06-inch-thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 PIPE HANGERS AND SUPPORT SPACING

A. Support horizontal steel and copper as follows:

1. ½-Inch to 1¼-Inch Pipe Size: 6’-0” maximum hanger spacing.
2. 1½-Inch to 2-Inch Pipe Size: 10’-0” maximum hanger spacing.

3. 2½-Inch to 3-Inch Pipe Size: 10'-0" maximum hanger spacing.
4. 4-Inch or Larger Pipe Size: 10'-0" maximum hanger spacing.

B. Pre-Insulated PEX Piping:

1. Support in accordance with the manufacturer's requirements but with spacing not exceeding every 3½ feet.
2. Minimum rod diameter shall be 3/8-inch for pipe sizes 2-inch and less, ½-inch for 2½ to 3 inches, 5/8-inch for 4-inch pipe size, and ¾-inch for pipe sizes larger that 4 inches.

3.3 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.

3.4 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 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.

3.5 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 1½ inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.7 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 non-metallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), 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 non-insulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two (2) rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one (1) of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1¼ 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 twenty-five percent (25%) 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 twenty-five percent (25%) 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 twenty-five percent (25%) 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 (2) vertical-type supports and one (2) trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers with vertical-limit stops.
8. Pipe riser resilient supports.
9. Resilient pipe guides.
10. Restrained vibration isolation roof-curbs.
11. Seismic snubbers.
12. Restraining braces and cables.
13. Steel vibration isolation equipment bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Provide wind and seismic restraints in accordance with the requirements of the Connecticut State Building Code.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

B. Delegated-Design Submittal: For vibration isolation, wind and seismic-restraint details 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. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Seismic and Wind-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.

C. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Isolation Technology, Inc.
2. Kinetics Noise Control
3. Mason Industries
4. Vibration Eliminator Co., Inc.
5. Vibration Isolation

B. Pads. Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two (2) separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to ¼-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than eighty percent (80%) of the compressed height of the spring at rated load.
4. Minimum Additional Travel: Fifty percent (50%) of the required deflection at rated load.
5. Lateral Stiffness: More than eighty percent (80%) of rated vertical stiffness.
6. Overload Capacity: Support two hundred percent (200%) of rated load, fully compressed, without deformation or failure.

E. Housed Spring Mounts: Housed Spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of ¼-inch travel up or down before contacting a resilient collar.

F. Elastomeric Hangers: Double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

G. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than eighty percent (80%) of the compressed height of the spring at rated load.
3. Minimum Additional Travel: Fifty percent (50%) of the required deflection at rated load.
4. Lateral Stiffness: More than eighty percent (80%) of rated vertical stiffness.
5. Overload Capacity: Support two hundred percent (200%) of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

H. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of two (2) steel tubes separated by a minimum of ½-inch-thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

I. Resilient Pipe Guides: Telescopic arrangement of two (2) steel tubes or post and sleeve arrangement separated by a minimum of ½-inch-thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 RESTRAINED VIBRATION ISOLATION ROOF CURBS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Isolation Technology, Inc.
2. Kinetics Noise Control
3. Mason Industries
4. Thybar Corporation
5. Vibration Eliminator Co., Inc.
6. Vibration Isolation

B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

C. Lower Support Assembly: Formed sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. The curb shall be built to seismically contain the roof top unit. The unit must be solidly fastened to the top floating rail and the lower section anchored to the roof structure.

E. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on ¼-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic and wind restraint.

    a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
    b. Outside Spring Diameter: Not less than eighty percent (80%) of the compressed height of the spring at rated load.
    c. Minimum Additional Travel: Fifty percent (50%) of the required deflection at rated load.
    d. Lateral Stiffness: More than eighty percent (80%) of rated vertical stiffness.
    e. Overload Capacity: Support two hundred percent (200%) of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

    a. Resilient Material: Oil- and water-resistant natural rubber.

F. Snubber Bushings: All-directional, elastomeric snubber bushings at least ¼-inch-thick.

G. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

H. Acoustic Barrier Package: The package shall consist of high transmission loss 2-inch-thick panel assembly. The panel shall be constructed of two (2) sheets of 16-gauge galvanized steel, filled with insulation, 2-inch-thick, 1.25 lbs./cu. ft. minimum density.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Amber/Booth Company, Inc.

2. California Dynamics Corporation
3. Isolation Technology, Inc.
4. Kinetics Noise Control
5. Mason Industries
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation
8. Vibration Mountings & Controls, Inc.

B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Anchor-bolt templates from supported equipment manufacturer.

2.4 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation
3. Cooper B-Line, Inc.; a division of Cooper Industries
4. Hilti, Inc.
5. Kinetics Noise Control
6. Loos & Co.; Cableware Division
7. Mason Industries
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four (4) times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum ¼-inch air gap, and minimum ¼-inch-thick resilient cushion.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building

structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 603 galvanized steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two (2) clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight (8) times diameter.

K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 FACTORY FINISHES

A. Finish: Manufacturer’s standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Install floor mounted pumps and pump stations on spring isolator mounts with a minimum static deflection of 2 inches.

B. Install hot water boilers on spring isolator mounts with a minimum static deflection of 0.25 inches.

C. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125-inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

D. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

E. Install cables so they do not bend across edges of adjacent equipment or building structure.

F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF DUCTWORK

A. Vibration Isolation of Ductwork:

1. All discharge runs for a distance of 50 feet from the connected equipment shall be isolated from the building structure by means of specification 10 hangers or specification 5 floor isolators. Spring deflection shall be a minimum of 0.75-inch.
2. All duct runs having air velocity of 1000 fpm or more shall be isolated from the building structure by specification 11 hangers or 5 floor supports. Spring deflection shall be a minimum of 0.75-inch.

B. Seismic Restraint of Ductwork:

1. Restrain rectangular ducts with cross sectional area of 6 sq. ft. or larger.
2. Restrain round ducts with diameters of 28 inches or larger.
3. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
4. Transverse restraints shall occur at 30-foot intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
5. Longitudinal restraints shall occur at 60-foot intervals with at least one (1) restraint per duct run. Transverse restraints for one (1) duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4 feet of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
6. The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
7. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
8. Walls, including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
9. Connection to the structure must be made with a non-friction connection.

C. Ductwork Exclusions

1. Rectangular and square and ducts that are less than 6 square feet in cross sectional area.
2. All trapezed ductwork where the distance from the suspension point to the trapeze member is 12 inches or less.

3. Ductwork hung with straps where the top of the duct is 12 inches or less from the suspension point and the strap has two (2) #10 sheet metal screws within 2 inches of the top of the duct.
4. If any suspension location in the run exceeds the above, the entire run must be braced.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven (7) days advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four (4) of each type and size of installed anchors and fasteners selected by Architect.
5. Test to ninety percent (90%) of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.7 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. 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.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multi-layer, multicolor, plastic labels for mechanical engraving, 1/16-inch-thick, and having pre-drilled holes for attachment hardware.

2. Letter Color: White.
3. Background Color: Black.
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 2½-by-¾-inch.
6. Minimum Letter Size: ¼-inch for name of units if viewing distance is less than 24 inches, ½-inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8½-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: Multi-layer, multicolor, plastic labels for mechanical engraving, 1/16-inch-thick, and having pre-drilled holes for attachment hardware.

B. Letter Color: Black

C. Background Color: Yellow.

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 2½-by-¾-inch.

F. Minimum Letter Size: ¼-inch for name of units if viewing distance is less than 24 inches, ½-inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Pre-printed, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1½ inches high.

2.4 DUCT LABELS

A. Material and Thickness: Multi-layer, multicolor, plastic labels for mechanical engraving, 1/16-inch-thick, and having pre-drilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2½-by-¾-inch.

D. Minimum Letter Size: ¼-inch for name of units if viewing distance is less than 24 inches, ½-inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

E. Fasteners: Stainless-steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. 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 1½ inches high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1¼ inches for ducts; and minimum letter height of ¾-inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Brass.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with ¼-inch letters for piping system abbreviation and ½-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.

B. Valve Schedules: For each piping system, on 8½-by-11-inch (A4) 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.

C. Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Included mounting screws.

1. Frame: Extruded Aluminum.
2. Glazing: ASTM C 1036, Type I, Class I, Glazing Quality B, 2.5-mm, single thickness glass.

2.7 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 5¼ inches minimum.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

2.8 ACCESS PANEL AND DOOR MARKERS: 1/16-inch-thick, engraved laminated plastic with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment. Fasteners: Self-tapping, stainless steel screws or contact type, permanent adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels**,** complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Hot Water:

a. Background Color: Yellow.
b. Letter Color: Black.

2. Gas:

a. Background Color: Yellow.
b. Letter Color: Black.

3.4 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-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 in each space where ducts are exposed or concealed by removable ceiling system.

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 HVAC terminal devices 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. Geothermal Water: 1½ inches round.
    b. Dual Temperature Water: 1½ inches round.
    c. Hot Water: 1½ inches round.
    d. Chilled Water: 1½ inches round.
    e. Gas: 1½ inches round.

2. Valve Tag Color:

    a. Geothermal Water: Natural.
    b. Dual Temperature Water: Natural.
    c. Hot Water: Natural.
    d. Chilled Water: Natural.
    e. Gas: Natural.

3. Letter Color:

    a. Geothermal Water: Black.
    b. Dual Temperature Water: Black.
    c. Hot Water: Black.
    d. Chilled Water: Black.
    e. Gas: Black.

3.6 VALVE SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 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 HVACGENERAL

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. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 ACTION SUBMITTAL

A. TAB Report: Documentation of work performed for ASHRAE 90.1 Section 6.7.2.3- “System Balancing”

1.5 INFORMATION SUBMITTALS

A. Qualification Data: Within fifteen (15) days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within fifteen (15) days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within thirty (30) days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. 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.

1.6 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. TAB Conference: Meet with Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven (7) days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Commissioning Authority.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.7 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.8 COORDINATION

A. Notice: Provide seven (7) days' advance notice for each test. Include scheduled test dates and times.

B. A factory-authorized service representative and the BAS Contractor shall be present when balancing and testing major equipment.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 COMMISSIONING OF SYSTEMS AND EQUIPMENT

A. Engage a factory-authorized service representative or technician who is familiar with this project to participate and assist, if necessary, in the functional performance testing of the equipment include in this Division with the Commissioning Agent.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 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" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 "Insulation" sections.

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.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. 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.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Division 23.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR INDUCTION-UNIT SYSTEMS

A. Balance primary-air risers by measuring static pressure at the nozzles of the top and bottom units of each riser to determine which risers must be throttled. Adjust risers to indicated airflow within specified tolerances.

B. Adjust each induction unit.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus five percent (+/-5%).

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first and then balance the secondary circuits.

3.11 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Check settings and operation of safety and relief valves. Record settings.

3.12 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.13 PROCEDURES FOR WATER-TO-WATER HEAT PUMPS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one (1) circuit operating in a multiple circuit installation, do not exceed the flow for the maximum tube velocity recommended by the water-to-water heat pump manufacturer. Measure and record the following data with each water-to-water heat pump operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. Geothermal loop water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by water-to-water heat pump manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
6. Capacity: Calculate in tons of cooling.

3.14 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.15 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.16 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.17 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus ten percent (+/-10%).
2. Air Outlets and Inlets: Plus or minus ten percent (+/-10%).
3. Heating-Water Flow Rate: Plus or minus ten percent (+/-10%).

3.18 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.19 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.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. 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. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.

i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft.
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.

i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. 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, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

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, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. 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.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. 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.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.

b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.

f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.20 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least ten percent (10%) of air outlets.
b. Measure water flow of at least five percent (5%) of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Commissioning Authority.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.
3. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either ten percent (10%) of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than ten percent (10%) of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.21 ADDITIONAL TESTS

A. Within ninety (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.

3.22 FOLLOW-UP SERVICES

A. Allow for three (3) scheduled visits during the six-month period following substantial completion to adjust system parameters based on Owner's observations.

END OF SECTION 230593

SECTION 230719 - HVAC 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 HVAC piping systems:

1. Heating hot water piping (indoor and outdoor).
2. Refrigerant piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail 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.
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.

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2 (DN 50).
2. Jacket Materials for Pipe: 12 inches long by NPS 2 (DN 50).
3. 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 and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

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 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Aeroflex USA, Inc.; **Aerocel**
b. Armacell LLC; **AP Armaflex**
c. K-Flex USA; **Insul-Lock, Insul-Tube**, and **K-FLEX LS**

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Johns Manville; **Micro-Lok**
b. Knauf Insulation; **1000-Degree Pipe Insulation**
c. Manson Insulation Inc.; **Alley-K**
d. Owens Corning; **Fiberglas Pipe Insulation**

2. 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. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; **Super-Stik**

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; **Thermokote V**

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; **Ramcote 1200** and **Quik-Cote**

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-96**
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **81-33**

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Aeroflex USA, Inc.; **Aeroseal**
b. Armacell LLC; **Armaflex 520 Adhesive**
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **85-75**
d. K-Flex USA; **R-373 Contact Adhesive**

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-127**
b. Eagle Bridges - Marathon Industries; **225**
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **85-60/85-70**
d. Mon-Eco Industries, Inc.; **22-25**

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements provide one (1) of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-82**
b. Eagle Bridges - Marathon Industries; **225**
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **85-50**
d. Mon-Eco Industries, Inc.; **22-25**

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Dow Corning Corporation; **739, Dow Silicone**

b. Johns Manville; **Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive**
c. P.I.C. Plastics, Inc.; **Welding Adhesive**
d. Speedline Corporation; **Polyco VP Adhesive**

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **Encacel**
b. Eagle Bridges - Marathon Industries; **570**
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **60-95/60-96**

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, thirty-three percent (33%) by volume and forty-six percent (46%) by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-10**
b. Eagle Bridges - Marathon Industries; **550**
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **46-50**
d. Mon-Eco Industries, Inc.; **55-50**
e. Vimasco Corporation; **WC-1/WC-5**

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: Sixty percent (60%) by volume and sixty-six percent (66%) by weight.
5. 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. Products: Subject to compliance with requirements, provide one (1) of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-50 AHV2**
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **30-36**
   c. Vimasco Corporation; **713** and **714**

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Phenolic: Subject to compliance with requirements, provide one (1) of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-76**
   b. Eagle Bridges - Marathon Industries; **405**
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **30-45**
   d. Mon-Eco Industries, Inc.; **44-05**
   e. Pittsburgh Corning Corporation; **Pittseal 444**

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one (1) of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-76**
   b. Eagle Bridges - Marathon Industries; **405**
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **95-44**
   d. Mon-Eco Industries, Inc.; **44-05**

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **CP-76**

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

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. Products: Subject to compliance with requirements, provide one (1) of the following:

    a. Johns Manville; **Zeston**
    b. P.I.C. Plastics, Inc.; **FG Series**
    c. Proto Corporation; **LoSmoke**
    d. Speedline Corporation; **SmokeSafe**

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; **Metal Jacketing Systems**
b. ITW Insulation Systems; **Aluminum and Stainless-Steel Jacketing**
c. RPR Products, Inc.; **Insul-Mate**

2. 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: 2.5-mil-thick polysurlyn.
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.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. ABI, Ideal Tape Division; **428 AWF ASJ**
b. Avery Dennison Corporation, Specialty Tapes Division; **Fasson 0836**
c. Compac Corporation; **104** and **105**
d. Venture Tape; **1540 CW Plus**, **1542 CW Plus**, and **1542 CW Plus/SQ**

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: Two percent (2%).
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Pre-cut 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. Products: Subject to compliance with requirements, provide one (1) of the following:

a. ABI, Ideal Tape Division; **491 AWF FSK**
b. Avery Dennison Corporation, Specialty Tapes Division; **Fasson 0827**
c. Compac Corporation; **110** and **111**
d. Venture Tape; **1525 CW NT**, **1528 CW**, and **1528 CW/SQ**

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: Two percent (2%).
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Pre-cut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Compac Corporation; **130**
b. Venture Tape; **1506 CW NS**

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: Five hundred percent (500%).
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. ABI, Ideal Tape Division; **488 AWF**
b. Avery Dennison Corporation, Specialty Tapes Division; **Fasson 0800**
c. Compac Corporation; **120**
d. Venture Tape; **3520 CW**

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: Five percent (5%).
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. ITW Insulation Systems; **Gerrard Strapping and Seals**
b. RPR Products, Inc.; **Insul-Mate Strapping, Seals, and Springs**

2. Stainless-Steel: ASTM A 167 or ASTM A 240, Type 304 ½-inch-wide with wing seal.

B. Wire: 0.062-inch soft-annealed, stainless-steel.

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. C & F Wire

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

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. 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 1½ inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than seventy-five percent (75%) of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at 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 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.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. 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.

E. 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 pre-formed 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 (2) times the thickness of pipe insulation, or one (1) 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 (2) times the thickness of pipe insulation, or one (1) 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 (2) times the thickness of pipe insulation, or one (1) 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.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe 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 pre-formed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF 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 pre-formed 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 pre-formed sections of same material as straight segments of pipe insulation when available.
2. When pre-formed 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 pre-formed sections of same material as straight segments of pipe insulation when available.
2. When pre-formed 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.

3.8 INSTALLATION OF PHENOLIC 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 pre-formed 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 pre-formed 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 pre-formed 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.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two (2) 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1½-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints, for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two (2) continuous beads of adhesive to seams and joints, one (1) bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two (2) 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 the adhesive has fully cured, apply two (2) 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 jackets.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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 (3) locations of straight pipe, three (3) locations of threaded fittings, three (3) locations of welded fittings, two (2) locations of threaded strainers, two (2) locations of welded strainers, three (3) locations of threaded valves, and three (3) locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective work if sample inspection reveals non-compliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable pre-formed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one (1) material is listed for a piping system, selection from materials listed is Contractor's option.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. Listed thicknesses shall be based on conductivity values of 0.21-0.27 BTU-IN/HR-FT^2-Deg F at 125 Deg F per ASTM C547.
2. All Pipe Sizes: Insulation shall be one (1) of the following:

a. Cellular Glass: 1-inch-thick.
b. Flexible Elastomeric: 1-inch-thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-inch-thick.
d. Phenolic: 1-inch-thick.
e. Polyisocyanurate: 1-inch-thick.
f. Polyolefin: 1-inch-thick.

B. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. Listed thicknesses shall be based on conductivity values of 0.25-0.29 BTU-IN/HR-FT^2-Deg F at 125 Deg F per ASTM C547.
2. Less than NPS 1½-Inch: Insulation shall be the following:

a. Mineral-Fiber, Pre-formed Pipe, Type I: 1½ inches thick.

3. NPS 1½-Inch and Larger: Insulation shall be the following:

a. Mineral-Fiber, Pre-formed Pipe Insulation, Type I, 2 inches thick.

C. Chilled Water Supply and Return, 60 Deg F and Below:

1. Listed thicknesses shall be based on conductivity values of 0.21-0.27 BTU-IN/HR-FT^2-Deg F at 125 Deg F per ASTM C547.
2. Less than NPS 1½-Inch: Insulation shall be the following:

a. Mineral-Fiber, Pre-formed Pipe, Type I: 1-inch-thick.

3. NPS 1½-Inch and Larger: Insulation shall be the following:

a. Mineral-Fiber, Pre-formed Pipe Insulation, Type I, 1-inch-thick.

D. Refrigerant Liquid, Suction and Gas Piping:

1. NPS 1 1/2 and Smaller: Insulation shall be one (1) of the following:

a. Cellular Glass: 1-inch-thick.
b. Mineral-Fiber, Pre-formed Pipe Insulation, Type I, 1-inch-thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. Listed thicknesses shall be based on conductivity values of 0.25-0.29 BTU-IN/HR-FT^2-Deg F at 125 Deg F per ASTM C547.
2. Less than NPS 1½-Inch: Insulation shall be the following:

    a. Mineral-Fiber, Pre-formed Pipe, Type I: 1½ inches thick.

3. NPS 1½-Inch and Larger: Insulation shall be the following:

    a. Mineral-Fiber, Pre-formed Pipe Insulation, Type I, 2 inches thick.

B. Chilled Water Supply and Return, 60 Deg F and Below:

1. Listed thicknesses shall be based on conductivity values of 0.21-0.27 BTU-IN/HR-FT^2-Deg F at 125 Deg F per ASTM C547.
2. Less than NPS 1½-Inch: Insulation shall be the following:

    a. Mineral-Fiber, Pre-formed Pipe, Type I: 1-inch-thick.

3. NPS 1½-Inch and Larger: Insulation shall be the following:

    a. Mineral-Fiber, Pre-formed Pipe Insulation, Type I, 1-inch-thick.

C. Refrigerant Liquid, Suction and Gas Piping:

1. NPS 1½ and Smaller: Insulation shall be one (1) of the following:

    a. Cellular Glass: 1-inch-thick.
    b. Elastomeric Foam: 1-inch-thick.

3.15 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. If more than one (1) material is listed, selection from materials listed is Contractor's option.

B. Piping, Concealed:

1. None.

C. Piping, Exposed:

1. PVC, Color-Coded by System: 20 mils thick.

3.16 OUTDOOR, 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. Piping, Exposed:

1. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.024-inch-thick.

END OF SECTION 230719

SECTION 230900 - INSTRUMENTATION AND CONTROL 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. Furnish all labor, materials, tools, equipment, and services to integrate new controls and equipment into the existing Direct Digital Facility Management System (DDC) as indicated, in accordance with the provisions of the contract documents.
2. Provide interface with existing Building Automation System (BAS) incorporating BACnet Testing Laboratories (BTL) certified BACnet devices communicating over a Master-Slave Token Passing (MSTP) network at the field level and BACnet network managers at the network level. The BAS shall consist of Direct Digital Control (DDC) controllers, Building Controllers (BC), network management tools, programming tools, web browser based Graphical User Interface, sensors, relays, valves, actuators, and other equipment as may be necessary to provide for a complete and operational control system for the HVAC and other building related systems as described within these specifications.
3. The DDC shall consist of the following:

    a. Complete Direct Digital Control System as indicated in accordance with the provisions of the contract documents.
    b. Open Systems Design – It is the Owner’s expressed goal to implement an open Building Automaton System that will allow products from different manufacturers and/or suppliers to be integrated into a single unified system in order to provide flexibility for expansion, maintenance, and service of the system.
    c. Communications – Provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open communication protocols in one (1) open, interoperable system. Where existing systems using proprietary protocols exist, a gateway or driver may be incorporated to provide for interoperability.
    d. Integration of existing HVAC equipment into the new DDC System.
    e. (1) Color Graphics Operator Workstation (OWS), report/ alarm printer.
    f. Network Control Panels communicating via an Ethernet network utilizing BACnet I/P protocol.
    g. Field Control Panels communicating via a BACnet MS/TP protocol. All field control panels will be fully programmable. Application specific controllers that are not fully programmable or configurable are not acceptable.
    h. Field devices including sensors, relays, contactors, transducers, switches, valves, dampers, and related electronic control components.
    i. This specification defines the minimum equipment and performance requirements for a Direct Digital Control System.

4. It shall be understood that the drawings and specifications describe the approximate locations of the work. Do not scale the drawings to determine exact positions and clearances. Obtain from Architect, Engineer, or the Owner any dimensions not shown.

5. Details of construction and/or workmanship where not specifically described herein or indicated on the drawings shall be subject to the Engineer's or Owner's approval. It is the intent of these specifications to provide complete systems, left in good working order, ready for operation, including necessary labor and materials, whether or not specifically shown on the drawings or mentioned herein.
6. Before submitting proposals, examine the specifications and all drawings relating to the work and become fully informed as to the extent and character of the work and the relation of the work to that of other Sections. Examine the drawings of other Sections to become familiar with all the problems and details of the building construction and to note conditions, which affect the work.

B. Related Requirements:

1. Where work specified under other Sections of these Specifications connects to equipment or systems which are a part of this Section, provide proper connection(s) to such equipment including trade coordination. The following sections may have direct links to the installation of the DDC system:

   a. Section 230500 "Common Work Results for HVAC".
   b. Section 230593 "Testing, Adjusting, and Balancing for HVAC".
   c. Section 230993 "Sequence of Operations for HVAC Controls".
   d. Section 233300 "Air Duct Accessories".
   e. Division 26 – Electrical

1.3 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum twenty (20) dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum twenty (20) dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than 2 seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within 6 seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within 5 seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as 5 seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

   a. Water Temperature: Plus or minus 1°F.
   b. Water Flow: Plus or minus five percent (+/-5%) of full scale.
   c. Water Pressure: Plus or minus two percent (2%) of full scale.
   d. Space Temperature: Plus or minus 1°F.
   e. Ducted Air Temperature: Plus or minus 1°F.
   f. Outside Air Temperature: Plus or minus 2°F.
   g. Dew Point Temperature: Plus or minus 3°F.
   h. Temperature Differential: Plus or minus 0.25°F.
   i. Relative Humidity: Plus or minus five percent (+/-5%).
   j. Airflow (Pressurized Spaces): Plus or minus three percent (+/-3%) of full scale.
   k. Airflow (Measuring Stations): Plus or minus five percent (+/-5%) of full scale.

l. Airflow (Terminal): Plus or minus ten percent (+/-10%) of full scale.
m. Air Pressure (Space): Plus or minus 0.01-inch wg.
n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
o. Carbon Dioxide: Plus or minus 50 ppm.

1.4 TECHNICAL PROPOSAL

A. A Technical Proposal shall be presented for review prior to a formal submittal. This proposal will be reviewed by the Engineer.

B. It is the intent of this specification to describe the performance requirements of the system. The Technical Proposal shall describe, in detail, all requirements and procedure for complete work.

C. Technical Proposal Content. A section-by-section listing of clarifications and exceptions taken to these specifications.

D. Identification by the manufacturer's part number of the individual DDC controllers to be provided.

1. Proposed Riser Diagram.
2. Product information sheets for each model of DDC controller identified on the DDC Riser Diagram.
3. Specific printed product information detailing the operator workstation hardware and software.
4. Project organization, including resumes of each project team member.
5. Project scheduling including anticipated manpower requirements to meet the Owner's schedule.
6. Locations of the DDC Contractor's branch office that would perform both routine maintenance and emergency repair services. Include resumes of each hardware and software technician who would be involved in performing onsite service.
7. Prior project list of five (5) Facility Management Systems of similar size, scope, and complexity, which have been completed and accepted by the Owner. Include Project Name, Project Owner, Project Address, Contact Name, Contact Phone Number, and a brief description of the system.

1.5 DEFINITIONS

A. Algorithm: A software procedure for solving a recurrent mathematical problem or logical problem.

B. Analog: A continuously varying signal value, such as current, velocity, or temperature.

C. Binary: Two-state signal where a high signal level represents ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition.

D. Control Process: The software required to perform a complete control loop from input signal to interlock logic, process calculation to final output signal control.

E. Control Wiring: Includes conduit, wire, and wiring devices to install a complete Control System including motor control circuits, interlocks, thermostats, PE and EP switches and like devices. Includes all wiring from a DDC cabinet to all sensors and points defined in the Points List summary or specified herein and required to execute the sequence of operation. Includes necessary power wiring to all DDC devices, digital controllers including terminal units and actuators.

F. Deadband: A temperature range over which no heating or cooling energy is supplied, such as 72-78°F, i.e. as opposed to a single point changeover or overlap, or a range from setpoint over which no control action is taken.

G. Direct Digital Control System: The portion of the DDC which provided closed loop control of all HVAC equipment.

H. Distributed Control: A system whereby all control processing is decentralized and independent of a central computer. The control system is built up of stand-alone controllers. A single controller failure shall not impact more than one (1) system.

I. Integration: The ability of control system components from different manufacturers to connect together and provide coordinated control via real-time data exchange through a common communications data exchange protocol. Integration shall extend to the operator's workstation software, which shall support user interaction with all control system components.

J. Intranet: Building data network installed as work of other divisions.

K. Network: A system of distributed control units that are linked together on a communication highway. A network allows sharing of point information between all control units. Additionally, a network provides central monitoring and control of the entire system from any distributed control unit location. First tier networks shall provide "Peer-to-Peer" communications. Second tier networks shall provide either "Peer-to-Peer", Master-Slave or Supervised Token Passing communications.

L. Peripheral: Input/Output equipment used to communicate with the computer and make copies of system outputs, peripherals include CRT, printer, tape deck, diskette, etc.

M. PID Control Loop: A mathematical calculation used to evaluate a control input and determined the control output value required to maintain the input value at setpoint. The PID (Proportional, Integral, Derivative) control loop shall have operator adjustable maximum rate of change, P and D gains and loop response time delay. The loop shall be self-integrating so that no integral constant is required, and the loop shall not be subject to "Integral Windup".

N. The term "provide" means "provide complete in place", that is, furnished and installed and ready for operation and use.

1.6 DESCRIPTION OF WORK

A. Provide all required controllers, sensors and devices to integrate HVAC equipment furnished as work of the contract into the existing Building Automation System (BAS or BMS) and to achieve the Sequence of Operation. Refer to Section 230993 "Sequence of Operations for HVAC Controls".

B. Furnish a totally native BACnet-based system, including a Microsoft Windows XP operator's workstation, based on a distributed control system in accordance with this specification for all mechanical systems, including but not limited to: boiler plant, dedicated outdoor air units, packaged rooftop units, air handling units, energy recovery ventilators, reheat coils, cabinet unit heaters, unit heaters, VRV heat pump systems, hot water finned tube radiation, terminal devices, and exhaust fans. The system shall be complete in all respects, including all labor, control accessories, hardware, software, and peripheral devices necessary to execute the sequence of operations, and provide automatic control for each piece of mechanical equipment.

C. The operator's workstation, all building controllers, programmable controllers, and all input/output devices shall communicate using the protocols and network standards as defined

by ANSI/AHSRAE Standard 135-2001, BACnet. In other words, all workstations and controllers, including the unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. No LON devices or proprietary devices will be accepted.

D. System will be fully expandable.

E. Only one (1) workstation will be required to operate or access all data.

F. All controllers will be **fully programmable**. Controllers that are “Application Specific” only or “Configurable” will be rejected.

G. Provide all necessary BACnet-compliant hardware and software to meet the system’s functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers. All materials and equipment used shall be standard components, regularly manufactured and not custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.

H. All materials and equipment used shall be standard components, regularly manufactured and not custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.

I. The DDC control shall possess a modular architecture, permitting expansion through the addition of more Direct Digital Control Panels.

J. Provide full DDC control of all HVAC equipment, as indicated per the sequence of operations and the input/output summary.

K. Provide new Controls or control interface for existing equipment where indicated.

L. The Controls System shall be designed and implemented entirely for use and operation on the Internet and the Owner’s Intranet. All aspects of the Controls Systems Operator Interface shall be provided to operate through an IT industry standard Web Browsers such as Internet Explorer or Netscape or approved equivalent. The Web Browser-based Operator Interface provided shall not require the procurement of licensing of any special or proprietary software from the Controls Contractor or its suppliers for the Controls Systems OWS. WEB access provided through embedded building controllers will not be acceptable.

1.7 WIRING

A. Installation of the entire building management system shall be by skilled electricians and mechanics, all of whom are properly licensed, trained, and qualified for this work. All wiring shall be installed in accordance with Division 26 Electrical Specifications.

B. Supervision and checkout of the system shall be accomplished by local branch engineers and technicians directly employed by the BMS Contractor.

C. Power wiring for all control equipment, shall be provided by the DDC control contractor from the nearest power panel for this purpose.

D. Electrical wiring for the DDC control shall be performed by qualified electricians directly employed or subcontracted by the BMS Contractor.

1.8 SUBMITTALS

A. Subsequent to acceptance of technical proposal, the BMS Contractor shall submit, within sixty (60) days after award, installation drawings and control strategies for review.

B. Each submittal shall have a cover sheet with the following information provided: Submittal ID number, date, project name, address, and title, BMS Contractor name, address, and phone number, BMS Contractor project manager, quality control manager, and project engineer names, email addresses and phone numbers.

C. Each submittal shall include the following information:

1. DDC Control riser diagram showing all DDC controllers, operator workstations, network repeaters, and network wiring.
2. One-line schematics and system flow diagrams showing the location of all control devices.
3. Points list for each DDC controller, including: Tag, Point Type, System Name, Object Name, Expanded ID, Display Units, Controller Type, Address, Cable Destination, Module Type, Terminal ID, Panel, Slot Number, Reference Drawing, and Cable Number
4. Vendor's own written description for each sequence of operations, to include the following:

    a. Sequences shall reference input/output and software parameters by name and description.
    b. The sequences of operations provided in the submittal by the DDC Contractor shall represent the detailed analysis needed to create actual programming code from the design documents.
    c. Points shall be referenced by name, including all software points such as programmable setpoints, range limits, time delays, and so forth.
    d. The sequence of operations shall cover normal operation and operation under the various alarm conditions applicable to that system.

5. User interface functional outline. The outline shall include each display screen to be provided data to be displayed, and links to other screens. The outline level hierarchy shall be:

    a. Site.
    b. Building.
    c. Floor.
    d. System.

6. Detailed Bill of Material list for each panel, identifying quantity, part number, description, and associated options.
7. Control Damper Schedules. This spreadsheet type schedule shall include a separate line for each damper and a column for each of the damper attributes, including Code Number, Fail Position, Damper Type, Damper Operator, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting, and Actuator Type.
8. Control Valve Schedules. This spreadsheet type schedule shall include a separate line for each valve and a column for each of the valve attributes, including, Code Number, Configuration, Close Off Pressure, Capacity, Valve CV, Calc CV, Design Pressure, Actual Pressure, and Actuator Type.
9. Schematic of each air handling system, hydronic system, etc., locating each control component on its respective unit with proper termination point identifiers (include legend). One (1) schematic shall be included for each individual air handling system.
10. Each schematic shall show a chart detailing all hardware components used. The chart shall include:

a. Schematic Control Symbol.
b. Quantity.
c. Manufacturer's Part Number.
d. Technical Sheet Reference.
e. Description of Part.

11. Each Direct Digital Control Panel (DDCP) shall be detailed in the submittal to identify termination boards within each panel and termination of their respective field points. Each termination point shall define the point name and point description by each terminal within the field panel. Point names and descriptors shall be consistent throughout the submittal on schematics, wiring diagrams, equipment lists, etc.
12. The Control manufacturer's technical reference sheets for each hardware component and application program shall be included in the submittal.

    a. Catalogued cut sheets of all equipment used. This includes, but is not limited to, the following: DDC panels, peripherals, sensors, actuators, dampers, control air system, components, and so forth.
    b. Range and scale information for all transmitters and sensors. This sheet shall clearly indicate one (1) device and any applicable options. Where more than one (1) device to be used is on a single sheet, submit two sheets, individually marked.
    c. Training course outlines for each 4-hour session.
    d. Hardware data sheets for all operator workstations, local access panels, and portable operator terminals.
    e. Software manuals for all applications programs to be provided as a part of the operator workstations, portable operator terminals, programming devices, and so forth for evaluation for compliance with the performance requirements of this specification.
    f. Initial project team Quality Assurance compliance report.

13. BMS Contractor shall not order material or begin fabrication or field installation until receiving authorization to proceed in the form of an approved submittal. BMS Contractor shall be solely responsible for the removal and replacement of any item not approved by submittal at no cost to the Owner.

1.9 CLOSEOUT SUBMITTALS

A. Five (5) copies of the Operation and Maintenance Manuals shall be provided to the Owner's representative upon completion of the project. The entire Operation and Maintenance Manual shall be provided on recordable CD media, and include the following:

1. Include the following documentation in the Hardware Manual:

    a. General description and cut sheets for all components.
    b. Detailed wiring and installation illustrations and complete calibration procedures for each field and panel device.
    c. Complete troubleshooting procedures and guidelines.
    d. Complete operating instructions for all systems.
    e. Maintenance Instructions: Document all maintenance and repair/replacement procedures.

2. Include the following documentation in the DDC Software Manual:

    a. Sequence of Operations.
    b. Program Listing of Software Source Code or Flow Chart Diagrams of Programming Objects.

c. Printed listing of controller and operator workstation database files.
d. Software Point Name Abbreviation List; include Name, Description, Controller where located, Point Type, and Point ID.
e. I/O Point List. Include Point Name, Controller Location, Point Number, Control Device, Range and Span.
f. Printouts of all reports, group listings, and alarm messages.
g. Index of all DDC point names with documentation, manual page number references.

3. Provide three (3) copies of all manufacturers manuals covering the installed system. This shall include, as a minimum:

a. System Engineering Manual.
b. System Installation Manual.
c. Programming Manual.
d. Engineering and Troubleshooting Bulletins.
e. Operator Workstation Software Manual.
f. All other pertinent manuals published by the control system manufacturer.

4. Record Drawings: Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal. All project drawings shall be supplied in .DXF file format.

B. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the project record drawings and product data sheets. All software shall be Windows XP compatible. A logically organized table of contents shall provide dynamic links to view and print all project record drawings and product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents. The CD-ROM shall contain adequate space for future system updates.

1.10 SYSTEM TURNOVER AND SERVICE

A. Upon completion of the installation, the DDC Control Contractor shall start up the system and perform all necessary testing and run diagnostics to ensure proper operation. An acceptance test in the presence of the Owner's Representative shall be performed. The acceptance test shall consist of a point-to-point checkout within each DDCP to ensure proper operation of all system components.

B. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

C. Problems that occur within approved hardware or software shall be corrected in an appropriate fashion under warranty. Any such occurrence shall not void previous approval; however, the DDC control contractor shall be responsible to attend to, and remedy, such items within the warranty period. Appropriate logs, schedules, and reports shall be maintained to reflect these items and their redress.

1.11 TRAINING OWNER'S INSTRUCTION

A. The DDC contractor shall provide four (4) copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the system. The DDC control contractor shall instruct the Owner's designated representatives in these procedures during the start-up and test period. The duration of the instruction period shall be no less than 16 hours. These instructions are to be conducted during normal working hours. The instructions shall consist of both hand-on and classroom training at the job site.

1.12 WARRANTY

A. The Building Management System, including all hardware and software components, shall be warrantied for a period of two (2) years following the date of acceptance. Any manufacturing defects arising during this period shall be corrected without cost to the Owner.

B. The BMS contractor shall submit directly to the Owner during the warranty period a proposal covering a Maintenance Agreement to include the newly installed components provided under this scope of work.

1.13 QUALITY ASSURANCE

A. Provide written approvals and certifications after installation has been completed.

B. Manufacturer must prove that he has been engaged in the production, installation and service of this type of equipment for at least ten (10) years and has a fully equipped, factory trained and authorized service organization.

C. The system control contractor shall have been an authorized installing contractor for the manufacturer of the native BACnet components for a minimum of five (5) years, and office shall be within forty-five (45) miles of project site. Installation of controls that are not native BACnet components does not constitute acceptable experience.

D. Final determination of compliance with these specifications shall rest solely with the Owner and Engineer who will require proof of prior satisfactory performance.

E. For any equipment submitted for approval, the BMCS contractor shall state what, if any, specific points of system operation differ from these specifications.

F. The DDC control contractor shall continue to bear the liability for replacement of substituted equipment in the event that the equipment fails to perform as specified, or to meet approval of all authorities having jurisdiction, within 12 months after beneficial use by the Owner.

1.14 WORK BY OTHERS

A. The Division 26 Electrical Contractor shall:

1. Supply, mount, and provide power wiring to all fire alarm devices and smoke detectors.
2. Install and provide power wiring to the motor controller and Variable Frequency Drives provided by the mechanical contractor.
3. Install and provide power wiring to each Terminal Equipment Controller (TEC) provided by the BMS contractor. The BMS contractor shall coordinate with work by other division.

B. The Division 23 Mechanical Contractor shall:

1. Install control valves and separable wells furnished by the BMS contractor.
2. Install all necessary piping connections required for flow devices.
3. Provide necessary blank-off plates (safing) required to install dampers that are smaller than duct size.
4. Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
5. Provide sheet metal baffle plates for air handling unit mixing boxes when required by BMS contractor to eliminate stratification and provide air volumes specified. Locate baffles by experimentation and affix and seal permanently in place only after stratification problem has been eliminated.

6. Provide access doors or other means of access through ducts for servicing control equipment.
7. Install all automatic dampers provided by the BMS contractor.
8. Provide a minimum of three (3) duct diameters (minimum 36 inches) of straight duct upstream from every air terminal unit inlet.
9. Provide for dry storage of terminal units and mounted TEC's upon receipt at job site.
10. Notify the BMS contractor that the terminal units are ready for inspection. Every terminal unit shall be installed after the BMS contractor has approved the TEC installation.
11. Insure all TEC's are located a minimum of 3 feet from all obstructions (walls, pipes, etc.) to remain accessible.
12. Install all airflow measuring devices in ductwork provided by the BMS contractor.

PART 2 - PRODUCTS

2.1 INSTALLATION CONTRACTOR

A. Acceptable Installers – Basis-of-Design:

1. CTC Building Solutions

B. Other Installers capable of meeting project requirements may be considered, subject to approval of Owner and Engineer.

2.2 MANUFACTURERS

A. Acceptable Manufacturers – Basis-of-Design:

1. Distech Controls
2. KMC Controls

B. Substitutions: The contractor may substitute equipment of manufacturers other than the Basis-of-Design manufacturer providing that the substitution is equivalent to the specified product and meets all project requirements. All substitutions are subject to the approval of the Architect/Engineer and Owner. Refer to Section 012500 “Substitution Procedures”.

C. Other manufacturer’s offering BACnet controls with HTML5 graphics which are fully compatible with the City-wide system, meeting the requirements described in this Section, subject to the approval of the Owner and Engineer.

D. Note: All portions of the specification must be met. If a listed manufacturer cannot or does not meet the specification in any way, the bid will be rejected. It shall be understood that, where catalog numbers of control equipment are mentioned, this will clearly identify the item in question together with its inherent characteristics, dimensions, functions and capacities.

2.3 NETWORK ARCHITECTURES AND DEVICES

A. Networks: All network managers supplied under this section shall bridge the Lonworks, BACnet or ModBus field bus to the Owner’s Local Area Network (LAN) and/or Wide Area Network (WAN) as designated by the Owner. The network managers shall communicate at no less than 100 Megabits/sec over the Ethernet network and shall support BACnet over IP, Java, XML, HTTP, Fox and SOAP for maximum flexibility as it relates to the integration of building data with enterprise information systems. The system shall provide support for multiple network managers, Building Controllers (BC), user workstations and, if specified, a local server. The WAN and/or LAN will be provided by others. The SI shall coordinate with the General

Contractor for the access to the WAN and/or LAN. User interface MUST be based on HTML5 graphics and trending. JAVA based user interface is NOT acceptable.

1. Network minimum physical and media access requirements:

    a. Ethernet; IEEE standard 802.3.
    b. Cable; 100 Base-T, UTP-8 wire, category 5 Minimum throughput; 100 Mbps.

2. Network Access – Remote Access: For Local Area Network installations; provide access to the WAN and/or LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). The Owner agrees to pay monthly access charges for connection and ISP.

B. Network – Field Level Controllers: The communication network between the field level controllers shall be Lonworks TP/FT 10 bus topology, BACnet MSTP, BACnet/IP, Modbus RS-485 or Modbus/IP. All wiring shall be provided in accordance with the standards for the appropriate protocol. The number of devices on any one network shall not exceed ninety percent (90%) of capacity. All field level controllers serving AHU, RTU and HW/CHW System must have interactive LCD Display allowing user access to all points locally at the controller.

C. Network Management Devices: These various devices will service multiple functions on the network depending on network design, communication medium and needed task. These functions can include: management of traffic on the network, reconfiguring and strengthening of signals, the conversion of protocols, normalizing of data, global management of alarms, trends and schedules, control logic, protocol conversion and web page hosting for use as a Graphical User Interface.

1. Building Controller (BC) – This device shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the BC. It shall be provided with these features:

    a. Web page hosting.
    b. Extended memory.
    c. Network management tools resident within the BC (optional).
    d. Appropriate hardware and driver(s) associated with the protocol it manages.
    e. Din rail mounted power supply.

2. LON to LON and Bacnet Routers and Repeaters – A router or repeater may be used on a LON segment between controllers and a BC as a means to manage traffic and reconfigure and strengthen a transmission signal. Routers shall be fully programmable and permit a systems integrator to define message traffic, destination, and other network management functions utilizing LONWORKS. A repeater or signal booster may only be used to increase ths signal strength of the communictions. Under no circumstances may it be used in the place of a router.
3. Server Functions and Hardware – Provide a Personal Computer server along with the Network management tools and server software, unlimited connectivity version. The server shall support all BCs connected to the customer's network whether local or remote. It shall be possible to provide access to all BC via a single connection to the server. In this configuration, each BC can be accessed from a remote Graphical User Interface (GUI) or from a standard Web Browser Interface (WBI) by connecting to the server. The server shall provide the following functions, at a minimum:

a. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
b. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any BC in the network, local or remote.
c. The server shall include a master clock service for its subsystems and provide time synchronization for all BCs.
d. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
e. The server shall provide demand limiting that operates across all BCs. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
f. Provide for browser based graphical home screen with links to each connected BC. See graphic section for additional details.
g. The server shall provide central alarm management for all BC supported by the server. Alarm management shall include:

    1) Routing of alarms to display, printer, email and pagers.
    2) View and acknowledge alarms.
    3) Query alarm logs based on user-defined parameters.

h. The server shall provide central management of log data for all BCs supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:

    1) Viewing and printing log data.
    2) Exporting log data to other software applications.
    3) Query log data based on user-defined parameters.

D. “Information sharing” shall be defined as the function of each DDCP to exchange data on the network trunk with other DDCP’s without the need for additional devices such as network managers, gateways or central computers.

E. “Stand-alone” shall be defined as the function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

F. All Controllers and control devices shall have HTML5 capability and support HTML5 interface.

G. All control devices will be electronic.

H. Server Hardware Requirements: The server hardware platform shall have the following requirements: NOTE: Update to Owner standards or latest industry standard performance levels for a PC server.

1. The Server shall be a PC with minimum Intel Core i5 Quad core 3.4 GHz processor with 8 GB RAM and a 1TB SATA hard drive with 6 GB/s transfer rate. It shall include a minimum 32X CD-ROM drive and 4-USB ports. A minimum 21-inch, HDMI, DVI-D video interfaces, minimum 1024 x 768 resolution, 4x3 Widescreen, LED color monitor with a minimum 60 Hz refresh rate shall also be included.
2. The server operating system shall be provided with latest Microsoft Windows Operating Systems server based software that corresponds to the current support version of the control system framework and browsers as well as the latest version of Symantec Antivirus Software including a 1-year upgrade subscription service to the Symantec software.

3. Connection to the BAS LAN network shall be via an Ethernet network interface card, 100 Mbps.
4. A system printer shall be provided. Printer shall be laser type with a minimum 600 x 600-dpi resolution and rated for 60-PPM print speed minimum.

I. Uninterruptable Power Supplies: Provide the OWS, Server, and each NCU with individual UPS to provide clean, reliable, noise-filtered power at all times and to protect and maintain systems operation throughout short-term power interruptions of up to 15 minutes duration.

2.4 BUILDING AUTOMATION SYSTEM CONTROLLERS

A. All controllers shall be designed for easy installation and servicing including removable enclosures, removable terminals, and factory applied labels for all I/O. All internal points within the Programmable Controllers shall be fully supported by the Graphical User Interface (GUI), allowing the user to easily modify them and monitor them. All the internal programming points (e.g. variables, constants, PID's, timers, inputs and outputs) shall be exposed to the network on dedicated network variable outputs. All controllers' programs and schedules shall contain non-volatile flash memory. Upon a loss of power all controllers shall perform a self-restart.

B. Programmable Controllers (PC) – A controller designed for more complex sequences of operations such as built up AHU, central plant operations, electrical monitoring, and control and management for chillers, boilers and generators. The PCs are to allow for the flexibility of custom control programming to meet the needed sequences of operation.

1. Performance – Each PC shall have a minimum of 64K of non-volatile flash memory for control applications and 128K non-volatile flash memory for storage with a minimum 32-bit processor. The PC shall have a minimum ambient operating temperature range of -0ºC to 70ºC or 32ºF to 158ºF.
2. Inputs – Analog inputs shall have the following minimum level of performance: 16-bit A to D resolution; allow monitoring of platinum 100 ohms, platinum 1000-ohm, nickel 1000 ohms, thermistor 10K type II, thermistor 10K type III, voltage input 0-10VDC, current input 4-20mA, digital input, pulsed input minimum 2 Hz.
3. Outputs – Outputs shall be either software configurable to be either analog or digital or dedicated digital only. Analog outputs shall be selectable as voltage of 0-10 VDC (linear) or 4-20mA or digital outputs shall be 0-12 VDC (off/on), floating or PWM. Outputs shall have an adjustable range of 2 seconds to 15 minutes. Output Resolution shall be a minimum 10-bit digital/analog converter. All individual outputs and power supply shall be protected by an auto reset fuse. There shall be an LED status indicator on each of the outputs.

C. Programmable Controller Features

1. Provide an onboard network communication jack.
2. The PC shall be provided with two (2) on-board RJ45 Connections. One (1) of the RJ45 connections shall serve as a single point connection for connecting a wireless receiver that will enable the PC to accept up to twelve (12) wireless inputs utilizing the EnOcean communications protocol. The wireless receiver shall have an integrated antenna. The supplier/provider shall provide documentation verifying the strength and reliability of the wireless signal with the submittal package. The second RJ 45 connection shall serve as a single point connection for an integrated room sensor (IRS) with an LCD display. The sensor shall have a fully customizable LCD display. It shall measure occupancy, relative humidity, carbon dioxide and temperature in a single integrated device. Using separate devices for the sensing of occupancy, relative humidity, carbon dioxide and/or temperature is not acceptable. Up to four (4) integrated room sensors shall reside on a single daisy-chained communication bus.

3. The LCU shall come standard with a color operator interface that provides real-time access to monitored inputs, setpoints, modes, values, statuses, and outputs.
4. The operator interface shall consist of:

    a. An icon-based, interactive backlit color display.
    b. A turn and select navigation jog dial to access, edit, and modify internal controller functions. The jog dial shall be used to navigate through menus, select options and icons, and change parameters. Scroll buttons (up, down, left and right) shall not be acceptable.
    c. Navigable menus to display, select, edit, and modify values and other controller information.
    d. List-based menus with a minimum of eight (8) lines of text.
    e. Icon-based menus.
    f. A display with the following minimum characteristics: a resolution of 400 W x 240 H pixels (WQVGA) with an effective viewing area of 2.4-inch L x 1.4-inch H, and 2.8-inch diagonal viewing area.
    g. The operator interface shall use color-codes with icons and text lists to indicate values and controller statuses.
    h. The operator interface shall, at a minimum, have the following functions:

        1) Points. The operator interface shall provide points list menus to view the inputs, setpoints, and output values such as hardware inputs/outputs, analog values, binary values, multistate values, Intelligent Space Sensor (ISS) inputs, and wireless inputs.

            a) The points list menus shall allow the operator to monitor, set, and override controller points and values.
            b) A color-code shall be used to indicate the conditions and statuses of points displayed in the points list menus.

        2) Alarms. The operator interface shall provide a controller's alarms menu to view details of an alarm, to acknowledge the alarm, and to view the alarm history.

            a) The alarm menu shall allow the operator to view the following type of alarms: active not acknowledged, active acknowledged, and inactive not acknowledged.
            b) The combination of an icon and its color state shall notify the operator of an alarm condition.
            c) The operator shall be able to select a single point in alarm to view further details such as the alarm to/from status, current status, event date and time, alarm event threshold, and alarm event value.

        3) Overrides. The operator interface shall provide an overrides menu to view a list of the controller's overridden points such as hardware input, hardware output, value, constant, or variable. The menu shall allow the operator to select an overridden point and to modify or release the override on the selected point.
        4) PID loops. The operator interface shall provide a PID Loops menu to view, configure, and adjust the PID parameters. The interface shall also provide visual PID tuning with live system response graphing (live-trend).
        5) The operator interface shall support Latin-based languages and allow the interface user to select from three (3) defined languages.
        6) The operator interface shall allow personalization of a contact information screen with a minimum of eight (8) lines of user configurable text as well as the option to add a color graphic such as a company logo. The tool shall

support, but not be limited to, image file formats such as GIF, PNG, JPG, etc.

7) Favorites. The operator interface shall allow access to a list of bookmarked points.
8) Weather. The operator interface shall provide a weather menu to view the current weather conditions with a weather status icon. The units shall be configured to be displayed in either metric or US units.
9) Password protected. The controller operator interface shall provide multi-level password protection, with user-defined, alphanumeric, name/password combinations. The operator interface shall return to lock mode after a user-defined log-off delay. A password icon shall indicate the lock mode state.
10) Settings. The operator interface shall provide a settings menu to view and configure date and time parameters such as the current time, time zone, and daylight savings time.

5. Enclosures – Provide for a plastic enclosure with a separate back plate with terminals such that the electronic portion of the controller can be easily removed for ease of installation and servicing.

D. Operator Workstation

1. The DDC Contractor shall provide and install a personal computer workstation for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the DDC controllers to facilitate greater fault tolerance and reliability.

a. PC Hardware – The personal computers shall be configured with the minimum requirements as follows:

1) Pentium i3 Microprocessor.
2) 1024 MB RAM Memory.
3) 250 GB Fixed Drive.
4) 48X CD-ROM Drive.
5) 101 Enhanced Keyboard.
6) Microsoft® Compatible Serial Mouse.
7) 20-Inch Flat Panel.
8) Microsoft® Windows XP or current level.
9) 3Com® TCP/IP 10BaseT Adapter.
10) Four (4) USB Ports.

2. Operating System Software: Windows XP or current level.

a. Complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
b. Provide software registration cards to the Owner for all included software.

3. Peripheral Hardware

a. Printers: Color inkjet by Hewlett Packard or equal.

E. Workstation Application Components

1. Operator Interface

a. An integrated software package shall be used as the operator interface program.
b. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
c. The operator workstation software shall provide context-sensitive help menus and instructions for each operation and/or application currently being performed.
d. All controller software operating parameters shall be displayed for the operator to view/modify from the operator workstation. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
e. The operation of the control system shall be independent of the operator workstation, which shall be used for operator communications only. Systems that rely on the operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

2. Alarms

a. Each workstation shall receive and process alarms sent to it by the control system. The alarm management portion of the operator workstation software shall, at the minimum, provide the following functions:

1) Log date and time of alarm occurrence.
2) Generate a “Pop-Up” window informing an operator that an alarm has been received.
3) Allow an operator, with the appropriate security level, to acknowledge, delete, or disable an alarm.
4) Provide an audit trail for alarms by recording operator acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the operator, the alarm, the action taken on the alarm, and a time/date stamp.
5) Record all alarms received at an operator’s workstation to that workstation’s hard drive.
6) Allow the operators to view/manage the alarm data archived to hard disk. Selection of a single menu item or tool bar button shall allow the user to acknowledge, disable, delete, or print the selected alarm.
7) Alarms shall be generated by the operator workstation for any controller that is “off-line” and is not communicating, or that does not have an active control program loaded.
8) Changes made to alarm setpoints from the Operator Workstation shall directly modify the controller alarm management database.

3. Reports

a. Reports shall be generated and directed to one (1) of the following: workstation displays, printers, or disk.

1) As a minimum, the system shall provide the following reports:

a) All points in the network.
b) All points in a specific controller.
c) All points currently in alarm.
d) All points in hardware override.
e) All weekly schedules.

b. All or selected point attributes, including, but not limited to:

1) Values.
2) Setpoints.
3) Alarm Limits.
4) Run Times.

c. All programmed holidays and associated schedules.
d. All active, unacknowledged alarms.
e. All active, acknowledged alarms.
f. Any and all other controller operating parameters.
g. The system shall allow for the creation of custom report point groups that shall be capable of including points from multiple controllers. Systems limiting point report displays to only a single controller's point database shall not be accepted.
h. The number of custom reports or display groups shall be limited by the amount of available system memory.
i. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report on the system printer for use as a building management and diagnostics tool.

4. Schedules

a. Equipment Scheduling:

1) Scheduling of up to forty-eight (48) discrete schedules with definable calendar dates and the capability of shifting to alternate calendar periods automatically.
2) Scheduling shall be activated by time of day/day of week, input or output state, or other scheduled states, and/or events.
3) Scheduling for time of day/day of week schedules shall have multiple on/off time pairs, include seven (7) days per week, and temporary schedule for Today/Tomorrow time pairs which will automatically revert to original schedule upon expiration.
4) Scheduling shall allow for definable timed override periods of up to 4 consecutive hours.

b. Holiday Scheduling:

1) Scheduling shall allow for up to sixteen (16) definable holiday periods.
2) Holidays shall be programmable for up to ninety-nine (99) consecutive days and allow for automatic repetition of holidays that occur on the same calendar date from year to year.

c. Start Optimization:

1) OS shall be capable of learning building thermal characteristics and respond to variable conditions.
2) OS shall start controlled equipment as late as possible prior to occupied time and as early as possible prior to unoccupied time.
3) OS shall be calculated based on outdoor temperature, zone temperature, and control setpoint/setback parameters. OS calculations shall be updated daily and shall support calculations for forty-eight (48) discrete time of day/day of week schedules.

d. Setpoint/Setback Optimization:

1) Setpoint/setback control shall modify zone temperature setpoints during unoccupied hours, reducing the heating/cooling load.
2) Timed override for each setpoint control shall permit unoccupied hours adjustments without operator involvement.

5. Password

a. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display, and database manipulation capabilities as he or she deems appropriate for each user, based on an assigned password.
b. Each user shall have the following: a password (four (4) characters minimum), and an access level (from 1 - 3).
c. The system shall have an administrator level that can allow each user to change his or her password at will.
d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
e. Three levels of access shall be supported as follows:

1) Level 1: Monitoring access functions with no parameter access change.
2) Level 2: Level 1 access with the addition of access to setpoint parameters, temporary time of day schedules, and data log points.
3) Level 3: Complete system database access for an advanced user.

f. A minimum of ten (10) unique passwords, including user initials, shall be supported.
g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

2.5 OPERATOR INTERFACE

A. General structure of workstation interaction shall be a standard client/server relationship. Server shall be used to archive data and store system database. Clients shall access server for all archived data. Each client shall include flexibility to access graphics from server or local drive. Server shall support a minimum of two hundred (200) clients simultaneously.

B. The Operator Workstation shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CAN's). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.

C. The Web Browser based Operator Interface shall not require the procurement or licensing of any special or proprietary software from the Controls Contractor or its suppliers for the Control System OWS.

D. Operators will access the system through a dedicated WEB server.

E. Workstation software will become the sole property of the customer. At no time will the customer be required to pay for software or software related "renewal" fees.

F. Alarm Management:

1. Prioritization: The installer shall set up all system analog points with high and low alarm limits. All digital system points shall be associated with a status feedback point and all exceptions shall be reported as alarms. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized and filtered to minimize nuisance reporting and to speed operator response to critical alarms.
2. Critical and Non-Critical Alarm Routing:

    a. Critical alarms shall be defined as chiller, boiler, generator, critical space temperature or humidity. Critical alarms shall be displayed at the workstation, printed at the alarm printer, and alpha paged to the on-duty maintenance person over the owners alphanumeric paging system. Alpha pages shall provide sufficient information to identify the equipment and the point in alarm and the time and date of occurrence.
    b. All other alarms shall be considered non-critical and shall be displayed and acknowledged before being sent to the alarm log.

3. Auto-Dial Alarm Management: In Dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request is made, or until the buffer space is full. The alarm buffer must store a minimum of fifty (50) alarms.

2.6 CENTRAL CONSOLE SOFTWARE

A. Provide an Internet Explorer graphical user interface through which system operation may be performed using a mouse or similar pointing device. Proprietary software will not be acceptable. The interface shall allow for all system operations and applications to be quickly and easily selected using the mouse in conjunction with groups of drop-down menus, lists, graphics and icons. Provide functionality such that all operations can also be performed using the keyboard as a backup interface device. Provide additional capability that allows at least ten (10) special function keys to perform often-used operations.

B. The software shall provide a multi-tasking environment that allows the user to run several applications simultaneously. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished using Microsoft Windows or similar industry standard software that supports concurrent viewing and controlling of systems operations. Provide functionality such that any of the following may be performed simultaneously, and in any combination, via user-sized windows.

1. Dynamic color graphics and graphic control.
2. Alarm reporting and acknowledging.
3. Time-of-day scheduling.
4. Trend data definition and presentation.
5. Graphic definition.
6. Graphic construction.

C. Graphic displays shall be high-resolution, multi-colored presentations of actual building data and parameters. Graphic displays may be quickly and easily viewed via any or all the following methods as a minimum:

1. Graphic links.
2. Drop-down menus.
3. Special function keys.
4. Points in alarm.

D. Graphic links shall be standard symbols, which can be located on graphic displays as desired by the user. These links shall allow the user to view any graphic display, either in a hierarchical fashion or as otherwise defined. The quantity of possible links shall be limited only by the space available on each display.

E. Drop-down menus may be used to view graphic displays by selecting from customized lists, which include all graphics available for viewing. Provide the capability to quickly scroll through all lists.

F. Special function keys shall be used to quickly view graphic alarm displays and user-defined default graphics, such as campus or building site plans. From the alarm display the user may quickly view the graphic on which the associated point in alarm resides.

G. Provide static and dynamic graphic display capabilities. Static displays such as site plans, building layouts, floor plans and schematics shall provide the user with maps to allow for quick and easy access to any building information.

H. Dynamic graphic displays may represent any real-time system information. Any system point or group of points may reside on a dynamic display. Dynamic displays such as schematics of any mechanical system or piece of equipment shall allow the user to monitor and control actual building operating parameters. Point values such as temperature, humidity and flow, and point status such as on/off, normal and alarm shall automatically and continually update to indicate current operating conditions. As a minimum, symbols, text and colors shall be dynamic in nature.

I. Provide functionality to allow for any analog point value to be displayed as an individual dynamic display window for use as a convenient control and diagnostic tool. The display window shall include the following information as a minimum:

1. Point name.
2. Point description.
3. Setpoint.
4. Current value.
5. Range of values.
6. High and low limit setpoints.

J. All values shall be displayed in both text and symbolic form, such as an analog bar, gauge or other standard measurement device. Setpoint values shall be changed by simply moving a pointer to the desired setting on the measurement device. After user verification of the correct setting the system shall control at the new setpoint. Provide the capability to superimpose these displays on their associated schematic graphics or on separate displays in user-defined groups.

K. Provide the capability to control any point from a dynamic graphic display. Relevant point information windows may be accessed by pointing to a symbol or text. Setpoints may be changed by simply entering the new value. Status may be changed by selecting from predefined lists. The display shall ask the user to verify the change before allowing the system to respond.

L. Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide the following spreadsheet graphic types as a minimum:

1. Weekly schedules.
2. Zone schedules.
3. Monthly calendars.

M. Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Each schedule shall include columns for each day of the week as well as holiday and special day columns for alternate scheduling on user-defined days. Equipment scheduling shall be accomplished by simply inserting occupancy and vacancy times into appropriate information blocks on the graphic.

N. In addition, temporary overrides and associated times may be inserted into blocks for modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.

O. Zone schedules shall be provided for each building zone as previously described. Each schedule shall include all commendable points residing within the zone. Each point may have a unique schedule of operation relative to the zone's occupancy schedule, allowing for sequential starting and control of equipment within the zone. Scheduling and re-scheduling of points may be accomplished easily via the zone schedule graphic.

P. Monthly calendars for a 24-month period shall be provided which allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

Q. System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting Schedule.

R. Provide trending capabilities that allow the user to easily monitory and preserve records of system activity over an extended period. Any system point may be trended automatically at time-based intervals or changes of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting.

S. Trend data report graphics shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or pre-defined groups of at least six (6) points. Provide additional functionality to allow any trended data to be transferred easily to an off-the-shelf spreadsheet package such as Lotus 1-2-3. This shall allow the user to perform custom calculations such as energy usage, equipment efficiency and energy costs and shall allow for generation of these reports on high-quality plots, graphs and charts. System server shall periodically gather historically recorded data stored in the building controllers and field controllers and archive the information Archived files shall be appended with new sample data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator’s workstation. Operator shall be able to scroll through all trended data. All trend log information shall be displayed in standard engineering units.

T. System shall include a Trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right clicking on value displayed on graphic, and then selecting Trend logs from the displayed menu.

U. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters

monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.

V. System shall display archived data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format the user shall be able to select a specific period of data to view.

W. Static graphs shall represent actual point data that has been trended and stored on disk. Exact point values may be viewed on a data window by pointing or scrolling to the place of interest along the graph. Provide capability to print any graph on the system printer for use as a building management and diagnostics tool.

X. Dynamic graphs shall represent real-time point data. Any point or group of points may be graphed, regardless of whether they have been predefined for trending. The graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the graph and take "snapshots" of screens to be stored on the PC disk for future recall and analysis. As with static graphs, exact point values may be viewed and the graphs may be printed.

Y. Provide a general-purpose graphics package such as PC Paint Plus or IN*A*VISION which shall allow the user to quickly and easily define or construct color graphic displays. In addition, provide a library of standard HVAC equipment and symbols such as air handling units, chillers, cooling towers and boilers and standard electrical symbols that shall aid the user in definition of standard or custom graphics. Additional libraries of standard symbols may be easily added to the package or the user can define or construct symbols as desired for additional customization. Graphic displays may be defined or created to represent any building parameter, mechanical system or group of system points as desired to facilitate building operation and analysis.

Z. Provide the user with the capability to easily define all system operating parameters. Libraries of standard application modules such as temperature, humidity and static pressure control may be used as "building blocks" in defining or creating new control sequences. In addition, the user shall have the capability to easily create and archive new modules and control sequences as desired via a word processing type format. Provide a library of standard forms to facilitate definition of point characteristics. Forms shall be self-prompting and incorporate a fill-in-the-blank approach for definition of all parameters. The system shall immediately detect an improper entry and automatically display an error message explaining the nature of the mistake.

AA. Provide the capability to backup and store all system databases on the PC hard disk. In addition, all database changes may be performed while the PC is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDCP’s. Similarly, changes made at the DDCP’s shall be automatically uploaded to the PC, ensuring system continuity. The user shall also have the option to selectively download changes as desired.

BB. Provide contact-sensitive help menus to provide instructions appropriate with operations and applications currently being performed.

CC. Multiple user security levels shall be provided to allow for various degrees of system access and control. Provide a minimum of four (4) levels of access, with each increasing level allowing control of additional system operations and applications. A minimum of twelve (12) unique passwords, including user initials shall be provided. The system shall automatically generate a report of log-on/log-off time and system activity for each user. Provide automatic log-off capability to prevent unauthorized system use. Automatic log-off time shall be user-definable in 1-minute increments and may be disabled if desired.

DD. Graphics shall be constructed for individual monitoring of the building systems, and shall include data from all points in the sequence of operations and the input/output summary. Graphics shall be created by the BMCS contractor to monitor the following systems:

1. An individual graphic for each Air Handling Unit System, including rooftop air handlers, fan-powered terminals, cabinet unit heaters, etc.
2. The boiler/heating plant including the pumps.
3. Chiller and chilled water flow.
4. Floor plans for each floor.
5. Overall building.

2.7 FIELD ENGINEERING TOOLS

A. Operator's workstation software shall include field-engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.

B. User shall be able to pick graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.

C. Programming tools shall include a real time operation mode. Function blocks shall display real time data and be animated to show status of data inputs and outputs when in real time operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.

D. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and other items that define unit to be controlled. Supply minimum of two hundred fifty (250) applications as part of workstation software.

E. Field engineering tool shall include Device Manager for automatic detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computer's hard drive. If needed, this file shall be downloaded to the appropriate controller by selection using the mouse.

F. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media.

2.8 BUILDING CONTROLLER – GLOBAL

A. All communication with operator workstation and all programmable controllers shall be via BACnet. Building controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz), at least four (4) master slave token passing (MS/TP) LANs, a point-to-point (PTP – RS-232) connection and an on-board modem.

B. Each MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.

C. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).

D. The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.

E. Building controller shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.

F. Programming shall be object-oriented using control function blocks, supporting DDC functions, one thousand (1000) Analog Values and one thousand (1000) Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.

G. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation or field computer.

H. Building controller shall provide battery-backed real-time (hardware) clock functions.

I. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of one and one-half (1½) years (cumulative).

J. Global control algorithms and automated control functions should execute via 32-bit processor.

K. Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.

L. BACnet Conformance

1. Building Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:

    a. Clock Functional Group.
    b. Files Functional Group.
    c. Reinitialize Functional Group.
    d. Device Communications Functional Group.
    e. Event Initiation Functional Group.

2. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. The Building Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internet work, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

M. Remote Communications

1. Provide all functions that will allow remote communications via the Owner's Intranet to off-site locations. Remote Access to the system will utilize a central WEB server. This WEB server will not be the same component utilized for the operator workstation.
2. Utilize IT Standard Netscape or Internet Explorer that allows operator to view and change all information associated with system on color graphic displays. Operator shall be able to change all parameters in this section from off-site location including all programming of building controllers and all programmable controllers including all terminal unit controllers.
3. Building controller shall have capability to call out alarm conditions automatically. If desired, controller may also send encoded message to digital pager. If an alphanumeric pager is in use by the operator, building controller shall be capable of sending a text or numeric string of alarm description. All building controllers connected to the local LAN.
4. Building controller shall have capability to call a minimum of twenty (20) different phone numbers. Numbers called may be controlled by type of alarm or time schedule.
5. Building controller and internal modem shall be capable of modem-to-modem baud rates of 33.6 Kbps minimum over standard voice-grade phone lines. Lower baud rates shall be selectable for areas where local phone company conditions require them.

N. Schedules: Each building controller shall support a minimum of two hundred fifty (250) BACnet Schedule Objects and two hundred fifty (250) BACnet Calendar Objects.

O. Logging Capabilities

1. Each building controller shall log as minimum one thousand (1000) trend logs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
2. Logs may be viewed either on-site or off-site via remote communication.
3. Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired.
4. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

P. Alarm Generation

1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
2. Each alarm may be dialed out as noted above.
3. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
4. Controller must be able to handle up to fifteen hundred (1500) alarm setups stored as BACnet event enrollment objects; system destination and actions individually configurable.

2.9 DISTRIBUTED CONTROL PANEL (DDCP)

A. The system shall utilize intelligent distributed digital control panels (DDCP) to interface with sensors being monitored and equipment being controlled by the building management and

control systems. Provide one (1) or more native BACnet programmable controllers for each air handler and provide native BACnet programmable controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller and remain on the workstation. "***Configurable" controllers that are not fully programmable will not be accepted. No auxiliary or non-BACnet controllers shall be used. Proprietary or LON protocols will not be accepted.***

B. Controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

1. Files Functional Group.
2. Reinitialize Functional Group.
3. Device Communications Functional Group.

C. Controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of three (3) inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.

D. Each DDCP shall execute all application programs, calculations and commands via a 16-bit microcomputer resident in the panel. The microcomputer shall permit floating point calculations to enable the performance of energy calculations.

E. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. Controller shall execute all program sequences ten (10) times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.

F. Each DDCP shall be capable of full operation either as a completely independent panel or as a part of the existing building-wide control system. All panels shall contain the necessary equipment for direct interface to the sensors and actuators connected to it. The DDCP network shall be able to detect changes in any DDC panel point status and report these changes to all terminals accessing the building-wide network.

G. Each DDCP shall include its own microcomputer direct digital controller, power supply, input/output modules, communications board, two (2) RS-232 communications port, and battery. The DDCP shall have built-in diagnostics to display at any operator's terminal the amount of available RAM in each DDCP on the network. Each DDCP shall perform continuous diagnostics, and any malfunction shall be annunciated at the operator's console as well as visually indicated at the DDC panel.

H. Failure of any DDCP on the system shall not affect the proper operation of the remaining system components.

I. The system shall be capable of phased start-up. That is, any DDCP shall be capable of properly communicating with the rest of the system while remaining panels are being installed.

J. UL Listings for each DDCP shall be UL916 (Energy Management Systems), UL864-OUDTZ (Signal Systems Unit). Units shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.

K. Cabinet for each DDCP shall be all metal construction NEMA 1 construction. Each panel, including cabinet, power supply, function cards and termination modules, shall be UL approved. Each panel shall have a pin-hinged door and master keyed lock.

L. Each DDCP shall be capable of proper operation in an ambient environment of 32 to 120 degrees F and ten to ninety percent (10-90%) RH.

M. The DDCP shall be furnished with a user programmable language and internal memory of at least 128Kb RAM for local storage of extended trend data.

N. Controller shall include support for intelligent room sensor. Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

2.10 DDCP PROGRAMMING FUNCTIONS

A. Resident software in the DDCP shall provide for custom programming of control strategies, point database, operator interface, network communications, facilities and energy management functions.

1. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral, and derivative control.
2. Operator Interface Program (OIP) that allows an English language user interface shall be provided with each DDCP. The OIP shall allow the user to program, interrogate, command and edit future DDCP's that may be added to the network via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access any future network additions from any DDCP and any DDCP within the existing facility. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.11 USER PROGRAMMABILITY

A. All temperature control strategies and energy management routines shall be definable by the operator through an operator interface device connected to any DDCP. The system shall be provided complete with all equipment, software and documentation necessary to allow a trained operator to independently perform the functions listed below.

1. Read the value of a measure variable (i.e., temperature).
2. Start or stop equipment.
3. Monitor the status of equipment being controlled.
4. Read the set point of a control loop.

5. Determine the control strategies that have been defined for a specific piece of equipment.
6. Generate displays of control strategies.
7. Add/delete control loops to the system.
8. Add/delete points to the system.
9. Create, modify or delete control strategies.
10. Assign sensors and/or actuators to a control strategy.
11. Tune control loops through the adjustment of control loop parameters.
12. Enable or disable control strategies.
13. Select points to be alarmable and define the alarm state(s).

B. Self-diagnostics that continuously monitor the proper operation of each DDCP unit shall be built into each unit. A malfunction of the DDCP shall be reported, and shall inform the operator of the nature of the malfunction and the panel affected. It shall be possible to annunciate malfunctions as well as other DDCP alarms at a selected operator's terminal.

2.12 DDCP SOFTWARE

A. Each DDCP shall be capable of independently performing the following control and energy management routines as a minimum:

1. Time of day scheduling.
2. Start/stop time optimization.
3. Economizer control.
4. Enthalpy changeover.
5. Outdoor air reset.
6. Event initiated programs.
7. Trending.
8. Power demand limiting.

B. In addition, each DDCP unit shall independently support the creation and modification of custom direct control algorithms based on arithmetic, Boolean or time-based logic. Each panel shall support the creation, modification or removal of control algorithms while operating. Such functions shall be programmed using a sequential, numbered-statement programming language. Each control loop shall be fully user definable as follows:

1. Sensors and actuators.
2. Control mode (proportional, integral, derivative, or combinations thereof).
3. Gains.
4. Control action.
5. Sampling time.

C. All temperature control functions shall be executed within the DDCP. Loop control shall be executed via direct digital control algorithms. The user shall be able to customize control strategies and sequences on control and shall be able to define appropriate control loop algorithms and choose the optimum loop parameters for loop control. All control loops provided under this contract shall be properly tuned P.I.D. control loops. If the network communication link fails or the other DDCP malfunctions, the control loop shall continue to function using the last value received from the DDCP.

D. The system shall allow custom control algorithms to be created locally within the DDCP via a portable-operator terminal, and centrally in the central console.

E. Resident software, which allows user interface using simple menus and single letter commands shall be, supplied standard with each DDCP. This software shall require the operator to have knowledge of specific point addresses or other such system-specific information to allow

access. Solutions, which require basic user interface software to be resident in personal computers or other extra devices, will not be acceptable.

F. The system shall permit the generation of the job- specific control strategies that can be activated in any of the following ways:

1. Continuously.
2. At a particular time of day.
3. When a specific measured or controlled variable reads a selected value or state.
4. When a piece of equipment has run a certain period of time.

2.13 TERMINAL EQUIPMENT CONTROLLER (Rooftop Units, Air Handling Units, etc.)

A. Provide one (1) native BACnet terminal equipment controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit. ***Controllers will be fully programmable.*** "***Configurable" controllers that are not fully programmable will not be accepted.***

B. BACnet Conformance

1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:

a. Files Functional Group.
b. Reinitialize Functional Group.
c. Device Communications Functional Group.

2. Standard BACnet object types supported shall include as a minimum: Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, 4–20 mA, dry contact signals and a minimum of three (3) pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.

D. All programs sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller ten (10) times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

E. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. As a minimum, fifty percent (50%) of the point outputs shall be of the Universal

type; that is, the outputs may be utilized either as modulating or two-state, allowing for additional system flexibility. In lieu of Universal outputs, provide a minimum of fifty percent (50%) spare outputs to each type via additional point termination boards or controllers. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal Equipment Controllers utilizing proprietary control signals and actuators shall not be acceptable.

F. Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type.

1. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable laptop or similar operator's terminal to control and monitor all hardware and software points associated with the controller. In lieu of an internal jack, provide a separate terminal jack mounted on a stainless-steel wall plate adjacent to the sensor to facilitate direct access to the controller via the terminal.
2. Each room sensor shall also include the following auxiliary devices:

    a. Setpoint Adjustment Dial.
    b. Override Switch.

3. The setpoint adjustment dial shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, DDCP or via the portable programming tool. In lieu of an integral adjustment dial, provide a separate dial mounted on a stainless-steel wall plate adjacent to the sensor to perform the specified functionality.
4. The override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, DDCP or via the portable programming tool. In lieu of an integral switch, provide a separate momentary contact switch mounted on a stainless-steel wall plate adjacent to the sensor to perform the specified functionality.

G. Each controller shall perform its primary control function independent of other DDCP network communication, or if network communication is interrupted. Reversion to a fail-safe mode of operation during network interruption is not acceptable. Should the controller reside on a DDCP network, the controller shall receive its real-time data from the DDCP clock to ensure network continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings. Controllers that incorporate proportional and integral (PI) control algorithms only shall not be acceptable.

H. Provide each terminal equipment controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Provide uninterruptible power supplies (UPS’s) of sufficient capacities for all terminal controllers that do not meet this powerful protection requirement. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

I. Each controller shall have connection provisions for a portable laptop or similar operator's terminal. This connection shall be possible at either the controller or at the matching room

temperature sensors as previously specified. The terminal may be used for readout of system variables, override control, adjustment of control parameters, air balancing, servicing and troubleshooting. The terminal shall provide the user with the following functionality as a minimum:

1. Display system status (heating, cooling, etc.).
2. Display all point values and setpoints.
3. Set and change all setpoints.
4. Set and change heating/cooling deadbands.
5. Set and change PID loop gains.
6. Set and change system mode (occupied/unoccupied).
7. Set and change system mode lines.
8. Override all setpoints.
9. Override all digital and analog outputs.
10. Command all digital and analog outputs.
11. Select application mode.
12. Assign controller address.

J. Controllers shall support the following library of control strategies to address the requirements of the sequences described in the "Execution" portion of this specification, and for future expansion:

1. Daily Schedules.
2. Comfort/Occupancy Mode.
3. Economy Mode.
    a. Standby Mode/Economizer Available.
    b. Unoccupied Mode/Economizer Not Available.
    c. Shutdown.
4. Lighting Logic Interlock to Economy Mode.
5. Temporary Override Mode.
    a. Temporary Comfort Mode (Occupancy-Based Control).
    b. Boost (Occupant Warmer/Cooler Control).

2.14 FIELD DEVICES AND SENSORS/INPUT DEVICES TO DDCP’s

A. Room: All space temperature sensors, which are used, as inputs to the DDCP's shall be the thermistor or RTD type. The range shall be 40-120 degrees F. at a factory calibration point of 77 degrees F. Accuracy shall be ± 0.5 degrees F at calibration point. Sensors will include local setpoint adjustment with +\- 2-degree F programmable, timed override. Sensors will include digital display including actual temperature and space temperature setpoint.

B. Single point duct temperature sensors shall be the thermistor or RTD type. The range shall be 40-150 degrees F with a factory calibration point of 77 degrees F. Accuracy shall be ± 0.5-degree F at calibration point. These sensors shall be used in unit discharge and return air ducts.

C. Averaging element sensors shall be the thermistor type to eliminate any necessary calibration adjustment for wiring length. The range shall be 20-120 degrees F at a factory calibration point of 70 degrees F. Accuracy of the sensor at calibration point shall be ± 1.1 degrees F. These sensors shall be used in unit mixed air or preheat coil discharge sections.

D. Outside air temperature sensor shall be the thermistor type to eliminate any necessary calibration adjustment for wiring length. The range shall be -58-122 degrees F and have accuracy at calibration point ± 0.5 degrees F.

E. Low temperature detectors (freezestats) shall be the manual reset type, two-position snap acting. Capillary shall have minimum sensitive length of 20 feet and shall be installed in serpentine fashion downstream from coil it is protecting. Each square foot of coil shall be protected by a section of the capillary. Where large coil size or multiple coil construction exceeds the limit of coverage of one unit, provide additional units placed in series to that coil area coverage is maintained. ***Acceptable manufacturers are Penn or Honeywell only.***

F. Room Humidity sensors shall be commercial grade with standard 4 - 20 ma outputs. he range shall be zero to ninety-nine percent (0-99%) RH. Stated accuracy shall be plus two percent (+2%) RH minimum.

G. Duct-mounted humidity sensors shall be commercial grade with 4-20 MA output, range shall be zero to ninety-nine percent (0-99%) RH accuracy will be plus or minus six percent (+\-6%) minimum. Will be mounted within manufacturers enclosure on ductwork.

H. CO_2 Sensors: Sensors shall use single or dual-beam absorption infrared diffusion technology (non-dispersive infrared), and shall have integral programming to perform automatic baseline calibration without user interface. The recommended manual recalibration period shall not be less than five (5) years.

I. Water temperature sensors shall be well-mounted insertion liquid temperature sensor, platinum element with a 10K ohm signal transmitted to the DDCP. The ranges used shall be appropriate with the application. The range applied for sensing hot water temperature shall be 70-220 degrees F and for sensing chilled and condenser water temperatures shall be 20-120 degrees F.

J. Differential Pressure Switches: The differential pressure range of the switch shall be selected to suit the application and shall have an adjustable set point. The switch shall have SPDT contacts rated at 9 amperes at 120-volt AC and be UL approved. The switch shall be mounted with the diagram in a vertical plan. The switch shall be capable of withstanding full system pressure on either side of the sensing element with atmospheric pressure on the other side, without damage to the switch or degradation of its calibration.

K. Liquid Detection Switch (Drain Pans): Normally energized when the power supply is switched on. Components shall be fully encapsulated against moisture ingress. Switching capable of 5A at 240VAC.

L. Temperature, Pressure, Flow and Level Transmitters: Transmitters shall produce a 4 to 20 mA output linearly proportional to the measured variable, with a minimum accuracy of one-half percent (0.5%) of the transmitter range. The range shall not exceed two hundred percent (200%) of the measured variable's normal maximum value.

M. Duct (or System) Static Pressure Measuring Devices: Provide, where indicated, duct static measuring devices capable of continuously monitoring the duct or system static pressure it serves. The pressure range of the switch shall be selected to suit the application and shall have an adjustable set point and deadband. The switch shall have at least one (1) SPDT contact rated at 9 amperes at 120-volt AC and be UL approved.

N. The duct static traverse probe shall be of extruded aluminum construction and (except for ¾-inch diameter probes with lengths of 24 inches or less) be complete with threaded end support rod, sealing washer and nut, and mounting plate with gasket and static pressure signal fitting.

The static traverse probe shall be capable of producing a steady, non-pulsating signal of standard static pressure, without need for correction factors, with an instrument accuracy of one-half percent (0.5%).

O. Pressure Transmitters shall be the 4 - 20 ma output type with zero and span adjustments. The range shall be 0-00.5", 0-1", 0-2", 0-5", or 0-10" w.c. as required by the application. Combined static error (non-linearity and hysteresis) shall be plus or minus one percent (±1%) of full range output. Transmitters shall be supplied to transmit a 4-20 ma signal to the DDCP for every flow measuring station and duct static pressure traverse probe.

P. Dewpoint Sensor: As manufactured by Sauter, will be provided by chilled beam manufacturer.

Q. Air Flow Monitoring

1. Provide combination airflow and air temperature measurement devices where required. Fan inlet sensors shall not be substituted for duct or plenum sensor probes indicated on the plans.
2. Each measuring device shall consist of multi-point sensors in one (1) or more probe assemblies per location, and a single remotely mounted microprocessor-based transmitter for each measurement location. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges. All integrated circuitry shall be temperature rated as ‘industrial-grade’. No electronic components other than the sensor elements shall be located at the sensing node. Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Conductor insulation for internal probe wiring shall be made from Kynar.
3. Each sensing point shall independently determine the airflow rate and temperature at each node, which shall be equally weighted in calculations by the transmitter prior to output as the cross-sectional average. Devices which average multiple non-linear variables are not acceptable. Pitot arrays are not acceptable. Devices using chip-in-glass, epoxy-coated or diode-case chip thermistors are not acceptable. Vortex-shedding devices are not acceptable.
4. Each independent airflow sensor node shall have a laboratory accuracy of plus or minus two percent (+/-2%) of Reading over the entire calibrated airflow range of 0 to 5,000 fpm for ducted or plenum mounted probes, or not less than 0 to 10,000 fpm for fan inlet mounted sensors. All sensor nodes shall be wind tunnel calibrated or field-verified against air velocity standards that are traceable to NIST.
5. Devices whose accuracy is the combined and independent accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the calibrated range.
6. Each independent temperature sensor node shall have a calibrated accuracy of +/-0.14° F over the entire operating temperature range of -20° F to 160° F and be calibrated or field-verified against temperature standards that are traceable to NIST.
7. Airflow/Temperature measuring devices shall be UL Listed as an entire assembly. Devices in UL-labeled enclosures are not equivalent and are not acceptable without a UL Listing.
8. Where fan inlet measurement is required, mounting styles shall be indicated on the plans as either “face mounting” or “throat mounting.” Face mounting shall provide no mechanical fastening in the throat or on the surface of the inlet cone and shall be used on all performance-sensitive plenum-type or plug fans.
9. Acceptable Manufacturers: EBTRON, Inc. (Basis-of-Design)

R. Current Sensing Switch

1. The current sensing switch shall be self-powered with solid state circuitry and a dry contact output. It shall consist of a current transformer, a solid-state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on

or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

2. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
3. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

S. Air Pressure Safety Switches

1. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
2. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.

T. Control Dampers

1. Furnish for installation by the sheet metal contractor, standard dampers suitable for use in temperatures from -50 degrees F to 200 degrees F. Frames shall be 5-inch x 1-inch x 16-gauge aluminum hat channel.
2. Dampers shall be of the galvanized dual blade type with linear stroke operators complete with motors. Blade action must be opposed. Straight blade type dampers are not acceptable. Blades shall be roll formed, airfoil double thickness 16-gauge galvanized steel blades, maximum of 6 inches wide. Axles shall be ½-inch plated steel hex. Bearings shall be molded synthetic and linkage concealed in frame.
3. Maximum single section shall be 48 inches wide and 72 inches high. When applications require more than one (1) damper section to fill opening, appropriate jack shifting shall interconnect sections.
4. Leakage factor in the closed position shall not exceed 0.001% of the normal rated airflow at 4-inch static pressure differential across the damper.
5. Extruded neoprene gaskets shall be provided to seal all mating surfaces. Blade edge seals shall be extruded dual durometer vinyl. The gaskets shall be field replaceable and carry a 10-year material replacement warranty. Jamb seals shall be flexible metal, compression type.
6. Damper discs and frames shall be constructed of formed galvanized steel. Linkage components shall be galvanized steel and aluminum. All shafting must be stainless steel with the exception of standard actuator-shafts. Critical rotating surfaces shall be protected by nylon bushings.
7. Dampers shall be similar to Ruskin **Model CD-50/60**.

U. Control Damper Actuators: Electronic damper operators shall be located outside the air stream whenever possible. All damper motors shall be spring return type and be of sufficient size to operate their respective dampers effectively.

V. Control Valves – Other Than Reheat/Radiation Valves

1. Control voltage shall be chosen by the BAS contractor to be compatible with this control system.
2. All heating valves will be fail safe, open to flow water through the heating coil.
3. Spring return, electronic motor actuators shall position control valves. All valves shall have shutoff discs and V-ring packing. Valve sizes of ½ through 2 inches shall be furnished with screwed or soldered ends with stainless-steel or bronze trim to suit the application.
4. Flanged valves with bronze trim shall be furnished for sizes 2½-inch and larger.
5. Lug type butterfly valves with bronze discs and disc seals suitable for the medium and expected temperature range may be used for valve sizes of 5-inch or larger provided that

the control signal for modulating valve applications employs both proportional and integral algorithms. The minimum rating for valve bodies shall be ANSI class 125.

6. Diverting Valves shall be used in 3-way water diverting applications. 3-way Mixing valves will not be used in diverting applications.
7. The BAS contractor shall size each control valve to provide the proper flow rate at the available differential pressure, and shall include the Cv of each valve in his submittal. Sizing control valves based on pipeline size is not acceptable.

W. Reheat and Radiation Valves

1. The reheat electronic actuator shall mount on the valve body and provide complete modulating control of the valve.
2. Radiation and Radiant Panels with water flow of less than 4 gallons will be two-position. Radiation or radiant panels with 4 gallons or above will be modulating.
3. The electronic actuator will require 24VAC.
4. The valves shall be bronze body with stainless-steel trim. The minimum rating for valve bodies shall be ANSI class 125.

X. Thermostats: Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

Y. Pilot Relays

1. Shall be of modular plug in design with retaining springs or clips.
2. Mounting base shall be snap mount.
3. Contacts shall be rated for 10 amps at 120 VAC.
4. Shall have a visual indicator light.

Z. Local Control Panels

1. All control panels shall be factory constructed, incorporating the DDC manufacturers standard designs and layouts (coordinate with control contractor). All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with sub-panel, hinged door, and key-locking latch.
2. In general, the control panels shall consist of the DDC controller(s), display module, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. The display module shall be flush mounted in the panel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be extended to a numbered, color-coded, and labeled terminal strip for ease of maintenance and expansion. Wiring to I/O devices shall be made from this terminal strip.
4. All other wiring in the panel, internal and external, shall be made to additional line or low voltage color-coded and labeled terminal strips. Low and line voltage wiring shall be segregated. All terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
5. All wiring for every control panel shall follow a common color-coded format. All terminal strip color coding and numbering shall follow a common format. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

PART 3 - EXECUTION/PERFORMANCE

3.1 COMMISSIONING OF SYSTEMS AND EQUIPMENT

A. Commissioning the DDC Control system is a mandatory documented performance requirement of the selected DDC Contractor for all control systems detailed in this Specification and sequence of operations. Commissioning shall include verification of proper installation practices by the DDC Contractor and subcontractors under the DDC Contractor, point verification and calibration, system/sequence of operation verification with respect to specified operation, and network/workstation verification.

1. Engage a factory-authorized service representative or technician who is familiar with this project to participate and assist, if necessary, in the functional performance testing of the equipment include in this Division with the Commissioning Agent.

B. Acceptance Check List: An acceptance checklist shall be completed that documents compliance with each item of this Specification.

C. Testing Procedure: Upon completion of the installation, the DDC Contractor shall start-up the system and perform all necessary testing and run diagnostic tests to ensure proper operation. The DDC Contractor shall be responsible for generating all software and entering all database information necessary to perform the sequences of control herein specified.

D. Testing Documentation: Prior to acceptance testing, DDC Contractor shall create, on an individual system basis, trend logs of input and output points, or have an automatic Point History feature for documentation purposes.

E. Field Points Testing

1. This step shall verify that all the installed points receive or transmit the correct information prior to loading/activating the system software.
2. ON/OFF commands from the workstation shall be performed in order to verify each binary output point.
3. All binary input points are to be tested using the HAND/OFF/AUTOMATIC selector switch on the associated motor control center or by manually jumpering across the field device contacts.
4. All analog output points providing pneumatic output control shall be tested using a command from the workstation to modulate the output from minimum calibrated signal to maximum calibrated signal.
5. All analog output points shall be tested using a command from the workstation to modulate the output device from minimum calibrated signal to maximum calibrated output.
6. All analog input points are to be tested by comparing the reading obtained through the workstations or portable terminal to the value of an independent testing meter.

F. Non-compliant Items: The Contractor shall remove and replace, at its expense, all items that are not in compliance with the Specification requirements.

3.2 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

C. Examine existing equipment designated for controls replacement and integration into the new BMS to determine hardware and gateway requirements.

3.3 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify mounting heights in first paragraph below with authorities having jurisdiction to comply with requirements of the Americans with Disabilities Act.

D. Verify location of thermostats, sensors and other exposed control sensors with Drawings and room details before installation. Install devices 60 inches above the floor.

E. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

F. Install stainless-steel cover style thermistors on the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

G. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

H. Install labels and nameplates to identify control components according to Section 230553 "Identification for HVAC Piping and Equipment."

I. Install refrigerant instrument wells, valves, and other accessories according to Manufacturer’s installation instructions.

J. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

K. Install all new controls and devices for existing HVAC equipment remaining, as required to fully integrate systems into the new Building Management System and achieve the Sequence of Operation indicated in Section 230993 “Sequence of Operations for HVAC Controls”.

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, and to assist in field testing. 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 unit operation. Remove and replace malfunctioning units and retest.

    a. Test and adjust controls and safeties.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.

D. Check DDC system as follows:

1. Verify that DDC controller power supply is from emergency power supply, if applicable.
2. Verify that wires at control panels are tagged with their service designation and approved tagging system.
3. Verify that spare I/O capacity has been provided.
4. Verify that DDC controllers are protected from power supply surges.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

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 control sequences for all HVAC systems, subsystems, and equipment.

B. Coordinate required control interface with the manufacturers of packaged equipment.

C. Provide control replacement for existing equipment where indicated.

1.3 DEFINITIONS

A. ATC: Automatic Temperature Control Contractor conducting work by and under this section.

B. BMS: Building Management System.

1. BMS and FMS and BMCS are equivalent regarding definition and scope.

C. DDC: Direct digital control.

D. VAV: Variable air volume.

1.4 CONTROL SEQUENCES

A. Cabinet Unit Heater

1. The system consists of a Hot Water Cabinet Unit Heater installed in the main entry vestibule with temperature controls as required to achieve the Sequence of Operation.

2. The Cabinet Unit Heater provides heat for the vestibule.

3. Cabinet Unit Heater shall be enabled by aqua-stat when hot water supply is available to Cabinet Unit Heater. Supply fan shall be cycled to maintain space temperature based on input from wall mounted space temperature sensor.

4. Space temperature shall be monitored and setpoint addressable at BMS headend.

B. Points List.

1. The following minimum points list shall be provided by BMS Contractor.

POINT LIST:		TO BE SET UP BY BMS CONTRACTOR
AI	Space Temperature	
DI	Supply Fan Status	Alarm on Fan Start Failure
AO	Space Temperature Setpoint	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230993

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Condensate drain piping.
4. Blowdown drain piping.
5. Air vent piping.
6. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air control devices.
3. Chemical treatment.
4. Hydronic specialties.
5. Grooved joint fittings.

B. Shop Drawings: Detail, at ¼-inch scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

D. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

E. Welding certificates.

F. Qualification Data: For Installer.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control test reports.

E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

F. Grooved joint couplings and fittings shall be shown on drawings and product submittals and be specifically identified with the applicable style or series number.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one (1) year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code - Steel."

C. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

E. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Makeup-Water Piping: 80 psig at 150 deg F.
3. Condensate-Drain Piping: 150 deg F.
4. Blowdown-Drain Piping: 200 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.

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. Anvil International, Inc.
b. Star Pipe Products.
c. Victaulic Company

2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
3. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, pre-lubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

D. Copper or Bronze Pressure-Seal Fittings:

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. NIBCO INC.
b. Viega

2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

E. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

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. T-DRILL Industries Inc.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.
b. Central Sprinkler Company
c. Star Pipe Products
d. Victaulic Company

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or

shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

3. Couplings: Ductile- iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

    a. Rigid Type: Housings 12 inches and smaller shall be installation-ready cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9 upon visual metal-to-metal pad contact without a torque requirement. Designs that permit gaps or spaces at bolt pads or require a torque (per written manufacturer's installation instructions) as a primary means of achieving joint rigidity not permitted.
    b. Flexible Type: Use in locations where thermal stress relief are required such as expansion loops or piping offsets. In lieu of each flexible connector at major equipment, three (3) flexible couplings may be used for vibration attenuation and shall be placed in close proximity to the vibrating source.
    c. Gaskets: Grade EHP EPDM for NPS 12 and smaller and Grade E EPDM for NPS 14 and larger.

I. Steel Pressure-Seal Fittings:

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. Victaulic Company

2. Housing: Steel.
3. O-Rings and Pipe Stop: EPDM.
4. Tools: Manufacturer's special tool.
5. Minimum 300-psig working-pressure rating at 230 deg F.

J. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.4 PRE-INSULATED PEX PIPING AND FITTINGS

A. PEX Carrier Tubing:

1. Carrier piping shall be polyethylene (PEX-A) cross-linked piping with Oxygen Diffusion Barrier. All tubing shall be protected with a manufacturer applied oxygen diffusion barrier. Oxygen barrier shall perform in accordance with DIN Standard 4726 or better.
2. Tubing shall be DIN and ASTM approved and stamped with the appropriate code references. The PEX pipe shall have an operating temperature of 203F at an operating pressure of 87 psig.
3. Tubing shall be sized as indicated and scheduled on the plans, without restriction or reduction of cross-section within the insulated jacket.

B. Internal Pipe Insulation:

1. Insulation of all carrier piping shall consist of a microcellular, cross-linked polyethylene foam in multi-layer arrangements. The insulation closed cell structure shall insure minimal water absorption at all times to preserve insulating effect against thermal loss.

a. Insulation shall have a thermal conductivity performance equal to DIN Standard 56212 or higher for underground thermal loss. Comply with ASTM C 591; thermal conductivity (k-value) shall not exceed 0.14 Btu x in./h x sq. ft. x deg F at 75 deg F after one hundred eighty (180) days of aging.

2. All material shall be CFC free and completely flexible to the radius required to meet the layout of the piping as shown on the plans.

C. HDPE Outer Jacket:

1. The exterior jacket shall be made of high-density polyethylene (HDPE) to protect the carrier pipe and insulating materials from external influences.
2. The jacket shall be cast with a corrugated pattern along its entire length. The corrugation pattern shall provide flexibility in the longitudinal direction and rigidity against radial forces.
3. Casing accessories include the following:

a. Joint Kit: Half-shell, pourable or split insulation, casing sleeve, and shrink-wrap sleeve.
b. Expansion Blanket: Elastomeric foam, formed to fit over piping.
c. End Seals: Shrink wrap the casing material to seal watertight around casing and carrier pipe.

D. HDPE Piping:

1. HDPE pipe and heat fused materials shall be manufactured from virgin polyethylene extrusion compound material in accordance with ASTM D 2513, Section 4.1 and 4.2. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D 3035, D 2447, or F 714. Fittings shall be manufactured to diameters, wall thickness, and respective tolerances as specified in ASTM D 3261 for butt fusion fittings, ASTM D 2683 for socket fusion fittings and ASTM F 1055 for electro fusion fittings.
2. The material shall have a Hydrostatic Design basis of 1600 psi at 73°F per ASTM D 2837. The material shall be listed in PPI TR4 as either PE 3408/3608 or PE 4710 piping formulation. The material shall be a high-density polyethylene compound having a minimum cell classification of PE345434, PE355434, or PE345534 with a UV stabilizer of C, D, or E as specified in ASTM D 3350 with the following exception: this material shall exhibit zero failures (F0) when tested for a minimum of 192 hours under ASTM D 1693, condition C, as required in ASTM D 3350.
3. Pipe 3 inches (nominal) and larger shall be manufactured in accordance with ASTM D 3035, with minimum (based on pressure rating) dimension ratio of 15.5).
4. Molded PE Fittings: ASTM D 2683 or ASTM D 3261, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

2.5 PLASTIC PIPE AND FITTINGS

A. PVC Plastic Pipe: ASTM D 1785, 80, plain ends as indicated in Part 3 "Piping Applications" Article.

2.6 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

F. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

    a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

H. Approved mechanical couplings shall be allowed.

2.7 DIELECTRIC FITTINGS

A. Description: Combination of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

    a. Capitol Manufacturing Company
    b. Central Plastics Company
    c. Hart Industries International, Inc.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Capitol Manufacturing Company
b. Central Plastics Company
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company
d. Pipeline Seal and Insulator, Inc.

2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Perfection Corporation; a subsidiary of American Meter Company
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Victaulic Company of America

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.8 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries

4. Taco

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Non-ferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/8 (DN 6).
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Non-ferrous.
3. Operator: Non-corrosive metal float.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/4 (DN 8).
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, ¾-inch-diameter gage glass, and slotted-metal glass guard.

E. Replaceable Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Replaceable heavy duty Butyl rubber. Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless-steel with EPDM seats.

F. Tangential-Type Air Separators:

1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
2. Air Collector Tube: Perforated stainless-steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.

4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

G. Air Purgers:

1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
2. Maximum Working Pressure: 150 psig.
3. Maximum Operating Temperature: 250 deg F.

H. Insulated Buffet Tank:

1. Tank shall be ASME Code constructed and stamped in accordance with Section VIII of the ASME Code.
2. Tank shall be registered with the National Board of Boiler and Pressure Vessel Inspectors and a certificate of shop inspection shall be furnished.
3. ASME working pressure shall be 125 psi. Material of construction shall be carbon steel.
4. Vessels above 42 inches in diameter shall be furnished with a 12-inch x 16-inch manhole.
5. Tank shall be furnished with an air vent, a ½-inch flexible, elastomeric thermal insulation black in color, and internal baffle to divert water flow.

2.9 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain anti-freeze or glycol solutions.

2.10 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with fifty percent (50%) free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with fifty percent (50%) free area.
4. CWP Rating: 125 psig.

C. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of ¾-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

D. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 (DN 50) and smaller shall be the following:

1. Type L (B) drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled water piping, aboveground, NPS 2 (DN 50) and smaller shall be the following:

1. Type L (B) drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

D. Chilled water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Pipe sleeve for in ground piping shall be the following:

1. Schedule 80 PVC plastic pipe and fittings and solvent-welded joints.

F. Makeup-water piping installed aboveground shall be the following:

1. Type L (B) drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

G. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.

H. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic

transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Grooved pipe and mechanical couplings shall be limited to locations where sufficient space exists for the installation of mechanical couplings. Contractor shall verify space requirements in field prior to ordering piping materials.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

N. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

O. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

P. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

Q. Install valves.

R. Install unions in piping**,** NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

S. Install flanges or grooved joint couplings in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

T. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).

U. Install expansion loops, expansion joints, anchors, and pipe alignment guides.

V. Identify piping as specified in Section 230553 "Identification for HVAC Piping and Equipment."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC Piping."

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 6 feet; minimum rod size, ¼-inch.
2. NPS 1 (DN 25): Maximum span, 6 feet; minimum rod size, ¼-inch.
3. NPS 1-1/2 (DN 40): Maximum span, 6 feet; minimum rod size, 3/8-inch.
4. NPS 2 (DN 50): Maximum span, 10 feet; minimum rod size, 3/8-inch.
5. NPS 2-1/2 (DN 65): Maximum span, 11 feet; minimum rod size, 3/8-inch.
6. NPS 3 (DN 80): Maximum span, 10 feet; minimum rod size, 3/8-inch.
7. NPS 4 (DN 100): Maximum span, 10feet; minimum rod size, ½-inch.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 5 feet; minimum rod size, ¼-inch.
2. NPS 1 (DN 25): Maximum span, 6 feet; minimum rod size, ¼-inch.
3. NPS 1-1/2 (DN 40): Maximum span, 6 feet; minimum rod size, 3/8-inch.
4. NPS 2 (DN 50): Maximum span, 8 feet; minimum rod size, 3/8-inch.
5. NPS 2-1/2 (DN 65): Maximum span, 8 feet; minimum rod size, 3/8-inch.
6. NPS 3 (DN 80): Maximum span, 10 feet; minimum rod size, 3/8-inch.

F. PEX and Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel or groove plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Non-Pressure Piping: Join according to ASTM D 2855.

J. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

K. Heat Fused Joints: Use manufacturer-recommended tool and procedure.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a two percent (2%) upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 (DN 20) bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 (DN 20) pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

H. Install floor mounted expansion tanks. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one (1) bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Section 230500 "Common Work Results for HVAC".

3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:

1. pH: 7-9.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Corrosion and Scale Inhibitor: 2000 ppm as total organic inhibitor.

    a. Molybdate: 200 to 300 ppm.
    b. Nitrate: 500 to 700 ppm.

B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

D. Fill systems indicated to have antifreeze or glycol solutions with the following concentrations:

1. Dual Temperature Water Piping: Minimum twenty-five percent (25%) propylene glycol.
2. Geothermal Water Piping: Minimum ten percent (10%) propylene glycol.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.

4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed ninety percent (90%) of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

3.10 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
8. Lubricate motors and bearings.

3.11 CLEANING

A. Flush hydronic-piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic-piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

B. Partial systems associated with individual (or groups) of phases of construction shall be cleaned prior to connection to infrastructure that was previously installed and cleaned. Submit reports to document cleaning procedures.

3.12 PIPE PRESSURE TEST

A. Preparation for testing: Prepare hydronic piping in accordance with ASME 1331.a and as follows:

1. Leave joints including welds uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints, which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
5. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.

B. Testing: Test hydronic piping as follows:

1. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
2. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of the liquid.
3. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low-pressure filling lines are disconnected.
4. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either ninety percent (90%) of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code For Pressure Piping, Building Services Piping.
5. After the hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

END OF SECTION 232113

SECTION 232116 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Condensate-drain piping.
4. Valves.
5. Air-vent control.
6. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F.
2. Makeup-Water Piping: 80 psig at 150 deg F.
3. Condensate-Drain Piping: 150 deg F.
4. Air-Vent Piping: 200 deg F.
5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC”.

B. Bronze, Combination Balancing & Shutoff Valves:

1. Manufacturers:

a. Armstrong
b. Bell & Gossett
c. Tour & Andersson/Victaulic

2. Body: Bronze or Ametal, Y-pattern globe valve.
3. Plug: Resin or Ametal.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Digital handwheel with concealed memory stop to retain set position.
8. CWP Rating: Minimum 125 psig.
9. Maximum Operating Temperature: 250 deg F.
10. Coil kit assemblies may be used to reduce space requirements and the number of joints.

C. Cast-Iron, Ductile-Iron or Steel, Combination Balancing & Shutoff Valves:

1. Manufacturers:

a. Armstrong
b. Bell & Gossett
c. Tour & Andersson/Victaulic

2. Body: Cast-iron, Ductile-iron or steel body, globe Y-pattern.
3. Stem Seals: EPDM O-rings.
4. Seat: PTFE or EPDM.
5. End Connections: Flanged or grooved.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Digital handwheel with concealed memory stop to retain set position.
8. CWP Rating: Minimum 125 psig.
9. Maximum Operating Temperature: 250 deg F.
10. Coil kit assemblies may be used to reduce space requirements and the number of joints.

D. Differential Pressure Controller.

1. Manufacturers:

   a. STAP
   b. Tour & Andersson
   c. Victaulic

2. Body: Ametal copper alloy (½-inch to 2-inch) and ductile-iron (2½-inch and larger).
3. Membrane: HNBR or EPDM.
4. End Connections: Threaded or flanged.
5. Capillary tube, hose kit, and all connection fittings shall be manufactured by controller manufacturer to ensure proper operation of installed STAP valves. Mechanical contractor and balancing contractor shall be trained on installation, connection, and balancing procedures by certified a factory representative.

E. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.

1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Low inlet-pressure check valve.
7. Inlet Strainer: Removable without system shutdown.
8. Valve Seat and Stem: Non-corrosive.
9. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves: ASME labeled.

1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Wetted, Internal Work Parts: Brass and rubber.
7. Inlet Strainer: Insert materials, removable without system shutdown.
8. Valve Seat and Stem: Non-corrosive.
9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

1. Manufacturers:

   a. Griswold
   b. Nexus
   c. Victaulic

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.

6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus five percent (+/-5%) over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.

2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers:

   a. Amtrol
   b. Armstrong
   c. Bell & Gossett
   d. Taco

2. Body: Bronze.
3. Internal Parts: Non-ferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/8.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg F.

B. Automatic Air Vents:

1. Manufacturers:

   a. Amtrol
   b. Armstrong
   c. Bell & Gossett
   d. Taco

2. Body: Bronze or cast iron.
3. Internal Parts: Non-ferrous.
4. Operator: Non-corrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

C. Bladder-Type Expansion Tanks:

1. Manufacturers:

   a. Amtrol
   b. Armstrong
   c. Bell & Gossett
   d. Taco

2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

3. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless-steel with EPDM seats.

D. Combination Air/Dirt Separators:

1. Manufacturers:

a. Bell & Gossett
b. Spirotherm
c. Taco
d. Wessels

2. Tank: One-piece steel body with flanged removable head and blowdown valve.
3. Coalescing Medium: Copper.
4. Pipe Connections: Four flanged ASME connections for primary/secondary piping.
5. Minimum Working Pressure: 150 psig at 270 deg F.
6. Size and Performance: Refer to Schedule on Drawings.

2.4 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged or grooved ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 40 -mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with fifty percent (50%) free area.
4. CWP Rating: 125 psig.

C. T-Pattern Strainers:

1. Body: Ductile iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with fifty-seven percent (57%) free area.
4. CWP Rating: 750 psig.

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

F. On Victaulic grooved installations, three flexible style couplings may be used in lieu of each flexible connector for vibration attenuation at major equipment. Couplings shall be placed in close proximity to the vibrating source in accordance with published guidelines.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install Y-pattern balancing valves at each branch connection to return main.

C. Install calibrated Y-pattern balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a two percent (2%) upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.

2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

G. Install expansion tanks on the floor. Vent and purge air from hydronic system and ensure that tank is properly charged with air to suit system project requirements.

END OF SECTION 232116

SECTION 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. Combination fire-smoke dampers.

1.3 ACTION 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. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and 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.

1.6 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.

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.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one (1) side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, 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, ¼-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 COMBINATION FIRE-SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Nailor.
2. METALAIRE, Inc.
3. Penn Ventilation Company, Inc.
4. Ruskin Company

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Fire Rating: 1½ hours.

D. Frame: Curtain type damper with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052- or 0.138-inch-thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

F. Mounting Orientation: Vertical.

G. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

H. Electro-Thermal Activation Device:

1. Electro Thermal Link, replaceable, 6 to 30 volts, 0.2 amps, 165 deg F (74 deg C) rated, fusible links.
2. UL Listed.
3. Electrical activation response time: 0.0005 seconds at 24 volts.
4. Heat fusible at 165 deg F.
5. Activated by local smoke detector.

2.3 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.

2.4 SOUND LAGGING INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Sound Seal

B. Flexible, 2 lb./square foot reinforced foil-faced mass loaded vinyl noise barrier, 0.23-inch-thick.

C. Foil-faced lag tape.

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 control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. 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.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts with maximum 60-inch lengths of flexible duct. Do not use flexible ducts to change directions.

O. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

P. Provide 6 feet minimum 12-inch-dia. lined flexible duct to each supply diffuser. Connect flexible ducts to metal ducts with liquid adhesive plus stainless-steel duct clamp.

Q. Flexible ducts to diffusers shall have a minimum of one (1) 90-degree bend between main duct and diffuser with a minimum radius of bend not less than 3 feet.

R. Install duct test holes where required for testing and balancing purposes.

S. 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 ¼-inch 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 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. Sidewall fixed face 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 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. 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.

C. Source quality-control reports.

1.4 DELIVERY, STORAGE AND HANDLING

A. Handle air terminal units and components carefully to prevent damage.

B. Store air terminal units and components in clean dry place off the ground. Protect from weather, water, and physical damage.

PART 2 - PRODUCTS

2.1 FINISHES

A. Except where otherwise specified, surface finish will be selected by the Architect. Interior finish shall be flat black.

2.2 ACCESSORIES

A. Each grille, register, and diffuser shall have the accessories required to perform satisfactorily and be fully adjustable. This includes opposed blade volume dampers, air deflectors, vanes, blanking quadrants, etc.

B. Dampers shall be omitted from the following:

1. Single exhaust grilles, transfer grilles.

2.3 SIDEWALL FIXED FACE GRILLES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Titus
2. Krueger
3. Price Industries
4. METALAIRE, Inc.

B. Material: Aluminum.

C. Finish: Baked enamel, white.

D. Face Blade Arrangement: Horizontal spaced ¾-inch apart.

E. Core Construction: Integral.

F. Frame: 1¼-inch-wide.

G. Mounting: Surface with countersunk screw and lay-in.

2.4 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. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

END OF SECTION 233713

SECTION 238239 - CABINET 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 unit heaters and cabinet unit heaters with hot-water coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. DDC: Direct digital control.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of piping valves and specialties.
7. Indicate location and arrangement of integral controls.
8. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. 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, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which cabinet 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. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Seismic Qualification Certificates: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

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. Include detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

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 two (2) spare filters for each filter installed.

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

A. Manufacturers:

1. Rittling
2. Slant-fin
3. Sterling
4. Trane
5. Vulcan

B. Description:

1. Factory-assembled and -tested unit complying with AHRI 440.

2. 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.
3. Comply with UL 2021.

C. Performance Requirements:

1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
3. Seismic Performance: Cabinet unit heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

    a. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified.

D. Coil Section Insulation:

1. Insulation Materials: ASTM C 1071; surfaces exposed to airstream shall have aluminum-foil facing erosion-resistant coating to prevent erosion of glass fibers.

    a. Thickness: Minimum ½-inch-thick.
    b. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
    c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
    d. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
    e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Cabinets:

1. Material: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.

    a. Vertical Unit, Exposed Front Panels: Minimum 0.0677-inch-thick galvanized sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
    b. Recessed Flanges: Steel, finished to match cabinet.
    c. Control Access Door: Key operated.
    d. Base: Minimum 0.0528-inch-thick steel, finished to match cabinet, 4 inches high with leveling bolts.
    e. Extended Piping Compartment: 8-inch-wide piping end pocket.
    f. False Back: Minimum 0.0428-inch-thick steel, finished to match cabinet.

F. Filters:

1. Minimum Arrestance: And a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
2. Glass Fiber Treated with Adhesive: Eighty percent (80%) arrestance and MERV 5.

G. Coils: Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1-inch and rated for a minimum working pressure of 200 psig and entering-water temperature of 220 deg F. Include manual air vent and drain.

H. Fam-Motor Assembly:

1. Fan and Motor Board: Removable.

a. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
b. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board.
c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

I. Factory, Hot-Water Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
2. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
3. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 threaded pipe and full-port ball valve in strainer drain connection.
4. Wrought-Copper Unions: ASME B16.22.

J. Control devices and operational sequences are specified in Sections 230900 "Instrumentation and Control HVAC" and 230993 "Sequence of Operations for HVAC Controls."

1. Manual fan-speed switch.

K. Interface with DDC System for HVAC Requirements:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at central workstation.
3. Interface shall be BAC-net compatible for central DDC system for HVAC workstation and include the following functions:

a. Adjust set points.
b. Cabinet unit-heater start, stop, and operating status.
c. Data inquiry, including supply-air and room-air temperature.
d. Occupied and unoccupied schedules.

L. Electrical Connection: Factory-wired motors and controls for a single field connection.

M. Capacities and Characteristics: Refer to Cabinet Unit Heater Schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive cabinet unit heaters and unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in locations 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. Coordinate wall openings for recessed cabinet unit heaters based on approved submittals.

B. Install rough-ins for piping and electrical connections.

C. Install equipment in accordance with manufacturer’s installation instructions.

D. Install wall boxes in finished wall assembly, seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

E. Install units to comply with NFPA 90A.

F. Install wall-mounted temperature sensors in electrical outlet boxes. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

G. Install new filters in each cabinet unit heater within two (2) weeks of Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Sections 232113 "Hydronic Piping" and 232116 “Hydronic Piping Specialties”. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to cabinet unit heater's factory hot-water piping package if provided. Install the piping package if shipped loose.

D. Comply with safety requirements in UL 1995.

E. Unless otherwise indicated, install union, gate, or ball valve and strainer on supply-water connection and union and calibrated balancing valve on return-water connection of cabinet unit heater. Hydronic specialties are specified in Sections 232113 "Hydronic Piping" and 232116 “Hydronic Piping Specialties”.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within twelve (12) months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) 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.

END OF SECTION 238239

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 078413 "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052-inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and one (1) or more sides equal to, or more than, 16 inches, thickness shall be 0.138-inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM and/or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Stainless steel. Include two (2) for each sealing element.
4. Connecting Bolts and Nuts: Stainless-steel of length required to secure pressure plates to sealing elements. Include one (1) for each sealing element.

2.3 GROUT

A. Non-metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Coordinate fire-stopping/grout with section 078413.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide ½-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Section 078413 "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use 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 them in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 078413 "Penetration Firestopping."

3.5 COMISSIONING OF EQUIPMENT

A. Engage a factory authorized service representative, who is familiar with this project, to participate and assist, if necessary, in the functional performance testing of the equipment included in this Division with the Commissioning Agent.

END OF SECTION 260500

SECTION 260509 - ELECTRICAL DEMOLITION REQUIREMENTS

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 involving electrical systems as described in Contract Documents.

B. Related Sections:

1. Section 260500 “Common Work Results for Electrical”
2. New and replacement work specified in appropriate specification sections.

1.3 SCHEDULING

A. Include on Construction Schedule sequence of individual electrical demolition operations.

B. Coordinate with Owner for equipment and materials to be removed by Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. All relocations, reconnections, and removals are not necessarily indicated on Drawings. All such work shall be included without additional cost to the Owner.

3.2 PREPARATION

A. Disconnect equipment that is to be removed or relocated. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work.

B. Where affected by demolition or new construction, relocate, extend, or repair raceways, conductors, outlets, and apparatus to allow continued use of electrical systems. Use methods and materials as specified for new construction.

3.3 PERFORMANCE

A. Perform drilling, cutting, block-offs, and demolition work required for removal of necessary portions of electrical system. Do not cut joists, beams, girders, trusses, or columns without prior written permission from the Architect.

B. Remove concealed wiring abandoned due to demolition or new construction. Remove circuits, conduits and conductors that are not to be re-used back to next active fixture, device or junction box.

C. Patch, repair, and finish surfaces affected by electrical demolition work, unless work is specifically called for under other Sections of the specifications.

3.4 CLEANING

A. Remove obsolete raceways, conductors, apparatus, and lighting fixtures promptly from site and dispose of legally.

END OF SECTION 260509

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.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

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. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Alcan Products Corporation; Alcan Cable Division
2. American Insulated Wire Corp.; a Leviton Company
3. Belden
4. General Cable Corporation
5. Senator Wire & Cable Company
6. Southwire Company

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC, mineral-insulated, and metal-sheathed cable, Type MI with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of 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.

2.3 SLEEVES FOR CABLES

A. Comply with requirements of Section 260500 “Common Work Results for Electrical” for sleeves.

2.4 SLEEVE SEALS

A. Comply with requirements of Section 260500 “Common Work Results for Electrical” for sleeve seals.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for all feeders including service entrance cables. 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. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway and metal-clad cable, Type MC.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway and metal-clad cable, Type MC.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits Installed Below Raised Flooring: Type THHN-THWN, single conductors in raceway and metal-clad cable, Type MC.

J. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway and metal-clad cable, Type MC.

K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

L. Class 1 Control Circuits: Type THHN-THWN, in raceway.

M. Class 2 Control Circuits: Type THHN-THWN, in raceway Power-limited cable, concealed in building finishes, Power-limited tray cable, in cable tray.

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 Section 260529 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 270528 "Pathways for Communications Systems."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.

    a. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with fire alarm system, may not contain any other wire or cable.

3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted if approved by AHJ.
4. Signaling Line Circuits: Power-limited fire-alarm cables must not be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one (1) riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire-alarm control panel and the transmitter. Install the number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A 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 un-spliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.6 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Comply with installation requirements of Section 260500 “Common Work Results for Electrical” for sleeves.

3.7 SLEEVE-SEAL INSTALLATION

A. Comply with installation requirements of Section 260500 “Common Work Results for Electrical” for sleeve seals.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than sixty (60) days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER 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. Section Includes:

1. UTP cabling.
2. 50/125 and 62.5/125-micrometer, multimode optical fiber cabling.
3. RS-232 cabling.
4. RS-485 cabling.
5. Low-voltage control cabling.
6. Control-circuit conductors.
7. Identification products.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. Ladder Cable Tray: A fabricated structure consisting of two (2) longitudinal side rails connected by individual transverse members (rungs).

F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

G. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

H. RCDD: Registered Communications Distribution Designer.

I. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

J. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using seventy-five percent (75%) or less of the plan area of the surface to support cables.

K. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

1. Vertical and horizontal offsets and transitions.
2. Clearances for access above and to side of cable trays.
3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
4. Load calculations that show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of a NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings by applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP and optical fiber cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is

operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6A and Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit
e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472-inch-thick hot-dip galvanizing, complying with ASTM A 123, Grade 0.55, not less than 0.002165-inch-thick.

a. Basket Cable Trays: Minimum 6 inches wide and 2 inches deep. Wire mesh spacing shall not exceed 2 by 4 inches.
b. Trough or Ventilated Cable Trays: Minimum nominally 6 inches wide.
c. Ladder Cable Trays: Nominally 18 inches wide, and a rung spacing of 12 inches.
d. Channel Cable Trays: One-piece construction, nominally 4 inches wide. Slot spacing shall not exceed 4½ inches o.c.
e. Solid-Bottom or Non-ventilated Cable Trays: One-piece construction, nominally 12 inches wide. Provide with solid covers.

C. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2½ inches deep.

2.2 BACKBOARDS

A. Description: Plywood, fire-retardant treated, ¾ by 48 by 96 inches. Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Berk-Tek; a Nexans company
2. CommScope, Inc.
3. Mohawk; a division of Belden CDT
4. Superior Essex Inc.

B. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket unless color is otherwise specified in another section.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, Plenum Rated: Type CMP complying with UL 1685.
b. Communications, Riser Rated: Type CMP or Type CMR in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Hubbell Premise Wiring
2. Orthotronics
3. Leviton Voice & Data Division
4. Panduit Corp.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus twenty-five percent (25%) spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. ADC
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company
4. Corning Cable Systems
5. Dynacom Corporation

B. Description: Unless modified by another section - Multimode, 50/125-micrometer, 12-fiber, nonconductive, tight buffer, optical fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA/EIA-568-B.3 for performance specifications.
3. Comply with TIA/EIA-492AAAA-B for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

a. General Purpose, Non-conductive: Type OFN or OFNG.
b. Riser Rated, Non-conductive: Type OFNR, complying with UL 1666.

5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
6. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
7. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.

C. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Berk-Tek; a Nexans company
2. CommScope, Inc.
3. Corning Cable Systems
4. Dynacom Corporation
5. Siemon Co. (The)

B. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, Type SC, Type ST, Type LC, Type MT-RJ connectors. Insertion loss not more than 0.75 dB.
2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 RS-232 CABLE

A. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two (2) pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with one hundred percent (100%) shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.8 RS-485 CABLE

A. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two (2) pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.

5. Flame Resistance: NFPA 262, Flame Test.

2.9 LOW-VOLTAGE CONTROL CABLE

A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One (1) pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One (1) pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.10 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83 and/or UL 44.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, Type XHHN, in raceway, power-limited cable, concealed in building finishes, power-limited tray cable, in cable tray, complying with UL 83 and/or UL 44.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.11 FIRE-ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, no less than No. 16 AWG as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a 2-hour rating.

1. Control-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Low-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multi-conductor Armored Cable: NFPA 70, Type MC, copper conductors, Type THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

2.12 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Brady Corporation
2. HellermannTyton
3. Kroy LLC
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.13 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows if possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than ½-inch from the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors: Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceway and Boxes for Electrical Systems."

E. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

F. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

G. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in non-metallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2½ inches.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Link End-to-End Attenuation Tests:

        1) Multi-mode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
        2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 260523

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, plus the following special applications:

1. Grounding and Bonding conductors.
2. Grounding and bounding connectors.
3. Grounding and Bonding Bushing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Grounding for sensitive electronic equipment.

C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

D. Field quality-control reports.

E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS and NFPA 70B.

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or a NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. 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.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, ¼-inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16-inch-thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16-inch-thick.

C. Grounding Bus: Pre-drilled rectangular bars of annealed copper, ¼ by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

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 (2) 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.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression and exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install a solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three (3) bands of green and two (2) bands of yellow.

C. Grounding Bus: Install in electrical and network equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. 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.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a non-metallic 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.

F. 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 ¼-by-4-by-12-inch 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 Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one (1) of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. 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.

3.4 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Contractor shall 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. 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**,** at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two (2) 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.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

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 (5) times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Non-metallic slotted support systems.
3. Associated hardware.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 “Cast-In-Place Concrete”.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

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. Non-metallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer’s standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least one (1) surface.

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. Fabco Plastics Wholesale Limited
d. Seasafe, Inc.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless-steel.
4. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. 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. The body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36, steel plates, shapes, and bars; black and galvanized.

G. 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 and 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.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

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 scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be ¼-inch 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 twenty-five percent (25%) in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1½-inch 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. The

minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

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 New Concrete: Bolt to concrete inserts.
2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
3. To Existing Concrete: Expansion anchor fasteners.
4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
5. To Steel: Welded threaded studs complying with AWS D1.1, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, Spring-tension clamps.
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 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, twenty-eight (28) day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

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 minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES 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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Section 078413 "Penetration Firestopping" specifies firestopping referenced by this Section.
2. Section 260529 "Hangers and Supports for Electrical Systems" specifies conduit hangers and supports referenced by this Section.
3. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels.
4. Section 270528 "Pathways for Communications Systems" and Section 271100 "Communications Equipment Room Fittings" specifies additional requirements for installation of conduits for communications cabling.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical non-metallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible non-metallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RMC: Rigid metal conduit.

J. RNC: Rigid non-metallic conduit.

K. PVC: Schedule 40 or 80 rigid PVC conduit.

1.4 SUBMITTALS

A. Product Data: For conduit, surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Coordination Drawings: Conduit routing plans, 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. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." 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 cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, 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.

E. Qualification Data: For professional engineer and testing agency.

F. Source quality-control test reports.

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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex
7. Maverick Tube Corporation
8. O-Z Gedney; a unit of General Signal
9. Wheatland Tube Company

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit and IMC.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040-inch, minimum.

F. EMT: ANSI C80.3.

G. FMC: Zinc-coated steel or aluminum.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel or die-cast and set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040-inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NON-METALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose
3. Arnco Corporation

4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products
10. Manhattan/CDT/Cole-Flex
11. RACO; a Hubbell Company
12. Thomas & Betts Corporation

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Arnco Corporation
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products

B. Description: Comply with UL 2024; flexible type, approved for plenum, riser, general-use installation.

2.4 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Cooper B-Line, Inc.
2. Hoffman
3. Square D; Schneider Electric

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include 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.

D. Wireway Covers: Hinged type, Screw-cover type, Flanged-and-gasketed type, or as indicated.

E. Finish: Manufacturer’s standard enamel finish.

2.5 NON-METALLIC WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Hoffman
2. Lamson & Sessions; Carlon Electrical Products

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Fittings and Accessories: Include 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.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect and Owner.

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Thomas & Betts Corporation
b. Walker Systems, Inc.; Wiremold Company (The)
c. Wiremold Company (The); Electrical Sales Division

B. Surface Non-metallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect and Owner from manufacturer's entire range.

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Butler Manufacturing Company; Walker Division
b. Enduro Systems, Inc.; Composite Products Division
c. Hubbell Incorporated; Wiring Device-Kellems Division
d. Lamson & Sessions; Carlon Electrical Products
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The)
g. Wiremold Company (The); Electrical Sales Division

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric
3. Erickson Electrical Equipment Company
4. Hoffman
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division
6. O-Z/Gedney; a unit of General Signal
7. RACO; a Hubbell Company

8. Robroy Industries, Inc.; Enclosure Division
9. Scott Fetzer Co.; Adalet Division
10. Spring City Electrical Manufacturing Company
11. Thomas & Betts Corporation
12. Walker Systems, Inc.; Wiremold Company (The)
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, cast feralloy, Type FD, with gasketed cover.

D. Non-metallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast iron or sheet metal, fully adjustable, rectangular.

F. Non-metallic Floor Boxes: Non-adjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Non-metallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

J. Cabinets:

1. NEMA 250, Type 1, 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.

2.8 SLEEVES FOR RACEWAYS

A. Comply with requirements in Section 260500 “Common Work Results for Electrical” for sleeves.

2.9 SLEEVE SEALS

A. Comply with requirements in Section 260500 “Common Work Results for Electrical” for sleeve seals.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit, IMC, RNC, Type EPC-40-PVC, RNC, Type EPC-80-PVC.

2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, RNC, Type EPC-40-PVC, RNC, Type EPC-80-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried unless indicated otherwise.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Polymer concrete enclosures with polymer-concrete frame and cover, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer-concrete frame and cover, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT, Surface metal raceway, surface non-metallic raceway (where specifically noted).
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Auto shop.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway, EMT.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway, EMT.
9. Raceways for Concealed General-Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway, Riser-type, optical fiber/communications cable raceway, Plenum-type, optical fiber/communications cable raceway, EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless-steel or non-metallic in damp or wet locations.

C. Minimum Raceway Size: ¾-inch 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.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in non-metallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Section 260529 "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three (3) 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from RNC, Type EPC-40-PVC, to rigid steel conduit, or IMC before rising above the floor.

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. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and non-metallic, rigid and flexible, as follows:

1. ¾-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.

2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two (2) 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations 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. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
d. Attics: 135 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041-inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, 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.

P. 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.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Comply with requirements in Section 260500 “Common Work Results for Electrical” for sleeves.

3.4 SLEEVE-SEAL INSTALLATION

A. Comply with requirements in Section 260500 “Common Work Results for Electrical” for sleeve seals.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

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. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Pre-printed, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, pre-printed, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch-wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2-by-2-by-0.05-inch, with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag, 0.015-inch-thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 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. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels: Pre-printed, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

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: Pre-printed, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2-by-2-by-0.05-inch, with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.015-inch-thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pre-tensioned, flexible, pre-printed, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches 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 thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Pre-printed, 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, pre-tensioned, flexible, pre-printed, 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, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches 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, 0.015-inch-thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

B. Furnish and install tape at location in accordance with NEC 110.26 for all electrical distribution equipment.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Pre-printed aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. ¼-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, non-fading, pre-printed, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. ¼-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: “DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: “WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16-inch-thick for signs up to 20 sq. inches and 1/8-inch-thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. 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.

D. 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.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1-inch.

2.9 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.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one-piece, self-locking.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.10 DATA RECEPTACLES

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. It should read “DATA ONLY”. Minimum letter height shall be 3/8-inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. 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.

2.11 RECEPTACLES ON EMERGENCY POWER

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in orange, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label. Install orange label with receptacle device for identification.

2.12 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify 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 maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. 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. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of

raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Standby Power.
3. Normal Power.

E. 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 service, 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. Colors for 480/277-V Circuits:

        1) Phase A: Brown.
        2) Phase B: Orange.
        3) Phase C: Yellow.

    d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two (2) turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Power-Circuit Conductor Identification, more than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags, non-metallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

I. 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.

J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer and load shedding.

N. 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: Adhesive film label. Unless otherwise indicated, provide a single line of text with ½-inch-high letters on 1½-inch-high label; where two (2) lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label. Stenciled legend 4 inches high.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. 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: Type written directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive and engraved laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Emergency system boxes and enclosures.
h. Enclosed switches.
i. Enclosed circuit breakers.
j. Enclosed controllers.
k. Variable-speed controllers.
l. Push-button stations.
m. Power transfer equipment.
n. Contactors.
o. Remote-controlled switches, dimmer modules, and control devices.
p. Power-generating units.
q. Monitoring and control equipment.
r. UPS equipment.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL 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 lighting control devices:

1. Time switches.
2. Outdoor and indoor photoelectric switches.
3. Standalone daylight-harvesting switching and dimming controls.
4. Indoor occupancy sensors.
5. Switchbox-mounted occupancy sensors.
6. Outdoor motion sensors.
7. Lighting contactors.
8. Emergency shunt relays.

B. Related Sections include the following:

1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product 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.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one (1) of the following:

1. Area Lighting Research, Inc.; Tyco Electronics
2. Grasslin Controls Corporation; a GE Industrial Systems Company
3. Intermatic, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls; a Genlyte Company
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Paragon Electric Co.; Invensys Climate Controls
8. Square D; Schneider Electric
9. TORK
10. Touch-Plate, Inc.
11. Watt Stopper (The)

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: SPST, DPST, and DPDT.
2. Contact Rating: 30-A inductive or resistive, 240-V ac, and 20-A ballast load, 120/240-V ac.
3. Program: On-off set points per detail on Drawing E603.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
5. Astronomic Time: All channels.
6. Battery Backup: For schedules and time clock.

C. Electromechanical-Dial Time Switches: Type complying with UL 917.

1. Contact Configuration: SPST, DPST, SPDT, and DPDT.
2. Contact Rating: 30-A inductive or resistive, 240-V ac, 20-A ballast load, 120/240-V ac.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
4. Astronomic time dial.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one (1) of the following:

1. Area Lighting Research, Inc.; Tyco Electronics
2. Grasslin Controls Corporation; a GE Industrial Systems Company
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls
7. Square D; Schneider Electric
8. TORK
9. Touch-Plate, Inc.
10. Watt Stopper (The)

B. Description: Solid state, with SPST and DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. Description: Solid state, with SPST and DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 30-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR PHOTOELECTRIC SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one (1) of the following:

1. Allen-Bradley/Rockwell Automation
2. Area Lighting Research, Inc.; Tyco Electronics
3. Eaton Electrical Inc; Cutler-Hammer Products
4. Grasslin Controls Corporation; a GE Industrial Systems Company
5. Intermatic, Inc.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. MicroLite Lighting Control Systems
8. Novitas, Inc.
9. Paragon Electric Co.; Invensys Climate Controls
10. Square D; Schneider Electric
11. TORK
12. Touch-Plate, Inc.
13. Watt Stopper (The)

B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
3. Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two (1) LEDs to indicate the beginning of on-off cycles.

2.4 INDOOR OCCUPANCY SENSORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one (1) of the following:

1. Hubbell Lighting
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. RAB Lighting, Inc.
6. Sensor Switch, Inc.
7. TORK
8. Watt Stopper (The)

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a ½-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.5 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one (1) of the following:

1. Allen-Bradley/Rockwell Automation
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products
4. GE Industrial Systems; Total Lighting Control
5. Grasslin Controls Corporation; a GE Industrial Systems Company
6. Hubbell Lighting
7. Lithonia Lighting; Acuity Lighting Group, Inc.
8. MicroLite Lighting Control Systems
9. Square D; Schneider Electric
10. TORK
11. Touch-Plate, Inc.
12. Watt Stopper (The)

B. Description: Electrically operated and electrically held, combination type with non-fused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with fifteen percent (15%) or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings and schedule, matching the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.

1. Monitoring: On-off status.
2. Control: On-off operation.

2.6 EMERGENCY SHUNT RELAY

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one (1) of the following:

1. LVS, Inc.
2. Sensor Switch
3. Watt Stopper

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts (dual-contact where required); complying with UL 924.

1. Coil Rating: 120-277 V or as indicated on Drawings.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than ninety percent (90%) coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be ½-inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within twelve (12) months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two (2) visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 260923

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. Twist-locking receptacles.
3. Receptacles with integral surge suppression units.
4. Wall-box motion sensors.
5. Isolated-ground receptacles.
6. Snap switches and wall-box dimmers.
7. Solid-state fan speed controls.
8. Wall-switch and exterior occupancy sensors.
9. Communications outlets.
10. Pendant cord-connector devices.
11. Cord and plug sets.
12. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
13. EPO mushroom switches

B. Related Sections include the following:

1. Section 271500 "Communications Horizontal Cabling" for workstation outlets.

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 pre-marking wall plates.

C. Samples: One (1) for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. 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 (1) source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one (1) 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. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, 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; **5351** (single), **5352** (duplex)
b. Hubbell; **HBL5351** (single), **CR5352** (duplex)
c. Leviton; **5891** (single), **5352** (duplex)
d. Pass & Seymour; **5381** (single), **5352** (duplex)

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, 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. Hubbell; **CR 5253IG**
    b. Leviton; **5362-IG**
    c. Pass & Seymour; **IG6300**

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, 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; **TR8300**
    b. Hubbell; **HBL8300SG**
    c. Leviton; **8300-SGG**
    d. Pass & Seymour; **63H**

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:

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; **GF20**
    b. Pass & Seymour; **2084**

2.4 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

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; **5362BLS**
    b. Hubbell; **HBL5362SA**
    c. Leviton; **5380**

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

C. Isolated-Ground, Duplex Convenience Receptacles:

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; **IG5362BLS**
b. Hubbell; **IG5362SA**
c. Leviton; **5380-IG**

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 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. Refer to floor plans for other configurations required for project.

B. Isolated-Ground, Single Convenience Receptacles, 125 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:

a. Hubbell; **IG2310**
b. Leviton; **2310-IG**

2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 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:

a. Cooper; **2221** (single pole), **2222** (two-pole), **2223** (three-way), **2224** (four-way)

b. Hubbell; **CS1221** (single pole), **CS1222** (two-pole), **CS1223** (three-way), **CS1224** (four-way)
c. Leviton; **1221-2** (single pole), **1222-2** (two-pole), **1223-2** (three-way), **1224-2** (four-way)
d. Pass & Seymour; **20AC1** (single pole), **20AC2** (two-pole), **20AC3** (three-way), **20AC4** (four-way)

C. Pilot Light Switches, 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:

a. Cooper; **2221PL** for 120 V and 277 V
b. Hubbell; **HPL1221PL** for 120 V and 277 V
c. Leviton; **1221-PLR** for 120 V, **1221-7PLR** for 277 V
d. Pass & Seymour; **PS20AC1-PLR** for 120 V

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated 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:

a. Cooper; **2221L**
b. Hubbell; **HBL1221L**
c. Leviton; **1221-2L**
d. Pass & Seymour; **PS20AC1-L**

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.7 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. LED Lamp Dimmer Switches: Modular; compatible with LED lamps and driver; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end greater than twenty percent (20%) of full brightness.

2.8 OCCUPANCY SENSORS

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:

a. Cooper; **OSD10N**
b. Hubbell; **AD2000W1**
c. Leviton; **OS SMT-MDW**
d. Pass & Seymour; **DW-100**
e. Watt Stopper (The); **DW-100**

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

B. Long-Range 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:

a. Hubbell; **ATD1600WRP**
b. Leviton; **ODW12-MRW**
c. Watt Stopper (The); **DT-200**

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft.

C. Wide-Range 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:

a. Hubbell; **ATP120HBRP**
b. Leviton; **ODWHB-IRW**
c. Pass & Seymour; **HS1001**
d. Watt Stopper (The); **CX-100-3**

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft.

D. Exterior Occupancy 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:

a. Leviton; **PS200-10**
b. Watt Stopper (The); **EW-100-120**

2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.9 COMMUNICATIONS OUTLETS

A. Refer to Division 27 sections.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Stainless, tamper resistant with trident pan head matching current building standard.
2. Material for Finished Spaces: Brushed stainless.
3. Material for Unfinished Spaces: Brushed stainless for flush box installations, raised galvanized for surface box installations.

4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet locations while in use.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, thermoplastic with lockable cover.

2.11 MULTI-OUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Hubbell Incorporated; Wiring Device-Kellems
2. Wiremold Company (The)

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Metal, with manufacturer's standard finish.

D. Wire: No. 12 AWG.

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Ivory and/or as selected by Architect and Owner from manufacturer’s entire range, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: Orange and/or as specified above, with orange triangle on face.

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 ensure 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. Pig tailing 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 in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to ¾ 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.
10. Install GFCI devices in all wet locations.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

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. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. 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, multi-gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

1. Receptacles and Switches: Identify panelboard and circuit number from which served. Use self-adhesive labels with black lettering on white field mounted on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. 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 six percent (6%) 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.

C. Test straight blade convenience outlets in patient-care areas and hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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:

1. Fusible switches.
2. Non-fusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers 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 and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
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, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. 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 and Construction Manager no fewer than seven (7) days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect and Construction Manager written permission.
4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) 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. Type HD, Heavy Duty, Single Throw, 600-V ac and 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three (3) padlocks and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Six-Pole, Single Throw, 600-V ac and 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three (3) padlocks and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 600-V ac and 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three (3) padlocks and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

5. Auxiliary Contact Kit: Two (2) NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical and/or Compression type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.2 NON-FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) 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. Type HD, Heavy Duty, Single Throw, 600-V ac and 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three (3) padlocks and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac and 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three (3) padlocks and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 600-V ac and 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three (3) padlocks and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: Two (2) NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical and/or Compression type, suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) 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. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 600-V ac and 240-V ac, 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate indicated fuses;

lockable handle with capability to accept three (3) padlocks; interlocked with cover in closed position.

C. Type HD, Heavy-Duty, Single-Throw Non-Fusible Switch: 600-V ac and 240-V ac, 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three (3) padlocks; interlocked with cover in closed position.

D. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.4 SHUNT TRIP SWITCHES

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. Cooper Bussmann, Inc.
2. Ferraz Shawmut, Inc.
3. Littelfuse, Inc.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three (3) padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

E. Accessories:

1. Oil-tight key switch for key-to-test function.
2. Oil-tight green ON pilot light.
3. Isolated neutral lug; two hundred percent (200%) rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac and/or 24-V dc coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) 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. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical and/or Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at thirty-five to seventy-five percent (35-75%) of rated voltage without intentional time delay.
7. Auxiliary Contacts: Two (2) SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One (1) NC contact that operates only when circuit breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with electronic and/or ground-fault trip unit; for interlocking ground-fault protection function.

11. Electrical Operator: Provide remote control for on, off, and reset operations.

2.6 MOLDED-CASE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) 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. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Mechanical and/or Compression type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at thirty-five to seventy-five percent (35-75%) of rated voltage without intentional time delay.
6. Auxiliary Contacts: Two (2) SPDT switches with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One (1) NC contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac and 24-V dc.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and/or Wash-Down Areas: NEMA 250, Type 4X.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 9.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with 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. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

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. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test 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. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than sixty (60) days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker eleven (11) months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified

END OF SECTION 262816

SECTION 265119 - LED 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 solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "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. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. HPBS Submittals:

1. Product Data for Section 16a-38k-5(d): For paints and coatings, including printed statement of VOC content.

D. Samples: For each luminaire housing supply at submittal stage a paint chip of the fixture color as specified on the fixture schedule for approval.

E. For luminaires and lamps ref to Product Schedule: Shipping carton/box designation to be clearly marked with same designations as indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) 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. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, 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.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and/or manufacturers' model numbers.

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. Lamps (Arrays) + Driver(s): One (1) spare for every twenty-five (25) of each type and rating installed. Furnish at least one (1) of each type.
2. Diffusers and Lenses: One (1) for every ten (10) of each type and rating installed. Furnish at least one (1) of each type.
3. Globes and Guards: One (1) for every ten (10) of each type and rating installed. Furnish at least one (1) of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

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.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. Bulb shape complying with ANSI C79.1.

F. Lamp base complying with ANSI C81.61 (where applicable).

G. CRI of minimum 80. CCT of 4000K.

H. Rated lamp life of 50,000 hours.

I. Lamps dimmable from one hundred to zero percent (100-0%) of maximum light output.

J. Internal driver.

K. Nominal Operating Voltage: 120-277 VAC.

1. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

L. Housings:

1. Extruded-aluminum or aluminum housing and heat sink.
2. Finish approval by Architect and Owner from manufacturer’s entire range.

M. Manufacturer – Base of Design

1. See Fixture Schedule on Drawings.

2.2 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 (100%) 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 minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum or aluminum housing and heat sink.
2. Powder-coat finish.

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.

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: ½-inch steel tubing with swivel ball fittings and ceiling canopy. Finish, same as luminaire.

C. Wires: ASTM A 641, Class 3, soft temper, zinc-coated steel, 12-gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of one hundred twenty-five percent (125%) of luminaire weight and vertical force of four hundred percent (400%) of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four (4) points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or bracing detail if shown on Drawings.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two (2) 5/32-inch diameter aircraft cable supports adjustable to 120 inches in length.
2. Pendant mount requirements per fixture schedule model number.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one (1) point and rod or wire support for suspension for each unit length of luminaire chassis, including one (1) at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four (4) locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within twelve (12) months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two (2) visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.

2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 265219 - EMERGENCY AND EXIT 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. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

    a. Testing Agency Certified Data: For all luminaires, photometric data certified by a qualified independent testing agency.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) 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. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment will be attached.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Ceiling-mounted projectors.
e. Sprinklers.
f. Access panels.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of luminaire.

D. Product Test Reports: For each luminaire for tests performed by a qualified testing agency.

E. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

C. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires and signs in mockups before starting installations.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
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 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: Five (5) years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four (4) years.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.

G. Bulb Shape: Complying with ANSI C79.1.

H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.

1. Emergency Connection: Operate one lamp continuously at an output of 1100 lumens each upon loss of normal power. Connect un-switched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to eighty percent (80%) of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    c. Humidity: More than ninety-five percent (95%) (condensing).
    d. Altitude: Exceeding 3300 feet.
4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium or lead-acid type as scheduled.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. 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.

I. Refer to Section 260923 “Lighting Control Devices” for requirements for UL924 emergency shunt relays.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. Emergency Luminaires: Shall be as indicated on Lighting Fixture Schedule on Drawings and described in Section, with the following additional features:

    a. Operating at nominal voltage of 12 V dc.
    b. Internal emergency power unit.
    c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.
    d. UL 94 5VA flame rating.

C. Remote Emergency Lighting Units:

1. Emergency Lighting Unit: Shall be as indicated on Lighting Fixture Schedule on Drawings.
2. Operating at nominal voltage of 12 V dc.
3. Wall mount with universal junction box adaptor.
4. UV stable thermoplastic housing, rated for wet locations.
5. Two (2) LED lamp heads.
6. External emergency power unit.

2.3 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. Operating at nominal voltage of 120/277 V ac.
2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.
4. Master/Remote Sign Configurations:

    a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
    b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

5. Exit Signs wired to emergency lighting power source (AC type): Shall be wired through a UL 924 listed relay providing connection to emergency lighting circuit with an alternate non-emergency circuit (normal lighting) to power the sign on a loss of the emergency circuit.

C. Photoluminescent Signs:

1. Use strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Include universal bracket for flush-ceiling, wall, or end mounting.
2. Unit shall be UL 924 listed for use above the door and for low-level applications for minimum 90-minute durations.
3. Furnish with extruded aluminum frame and concealed mounting hardware.
4. Chevrons shall be self-adhesive type, meeting NFPA requirements.
5. Unit shall carry 10-year warranty.

D. Specified Signs for Accessible Exit shall meet power and illumination requirements for exit signs. These shall be furnished with universal symbol of accessibility (wheelchair symbol – dynamic character) having a minimum height of 6 inches and meeting the requirements of IBC 1011.1.2.

2.4 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:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. 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. Prismatic or Clear, UV-stabilized acrylic.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: One hundred percent (100%) virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum or polycarbonate housing as scheduled.

E. Conduit: Rigid galvanized steel, minimum ¾-inch in diameter.

2.5 METAL FINISHES

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.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641, Class 3, soft temper, zinc-coated steel, 12-gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of one hundred percent (100%) of luminaire and emergency power unit weight and vertical force of four hundred percent (400%) of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four (4) locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four (4) locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within twelve (12) months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265219

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Non-metallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Non-metallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of pathway groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal 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 certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Alpha Wire Company
4. Anamet Electrical, Inc.
5. Electri-Flex Company
6. O-Z/Gedney; a brand of EGS Electrical Group
7. Picoma Industries; Subsidiary of Mueller Water Products, Inc.
8. Republic Conduit
9. Robroy Industries
10. Southwire Company
11. Thomas & Betts Corporation
12. Western Tube and Conduit Corporation
13. Wheatland Tube Company; a division of John Maneely Company

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040-inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040-inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NON-METALLIC CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Arnco Corporation
5. CANTEX Inc.
6. CertainTeed Corp.
7. Condux International, Inc.
8. Electri-Flex Company
9. Kraloy
10. Lamson & Sessions; Carlon Electrical Products
11. Niedax-Kleinhuis USA, Inc.
12. RACO; a Hubbell company
13. Thomas & Betts Corporation

B. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Rigid HDPE: Comply with UL 651A.

E. Continuous HDPE: Comply with UL 651B.

F. RTRC: Comply with UL 1684A and NEMA TC 14.

G. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Alpha Wire Company
2. Arnco Corporation
3. Endot Industries Inc.
4. IPEX
5. Lamson & Sessions; Carlon Electrical Products

B. Description: Comply with UL 2024; flexible-type pathway, approved for plenum installation unless otherwise indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 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.
2. Comply with TIA-569-B.

C. 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.

D. Wireway Covers: Hinged or Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer’s standard enamel finish.

2.5 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Mono-Systems, Inc.
b. Niedax-Kleinhuis USA, Inc.
c. Panduit Corp.
d. Wiremold/Legrand

C. Surface Non-metallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Hubbell Incorporated; Wiring Device-Kellems Division
b. Lamson & Sessions; Carlon Electrical Products
c. Mono-Systems, Inc.
d. Panduit Corp.
e. Wiremold/Legrand

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Adalet
2. Cooper Technologies Company; Cooper Crouse-Hinds
3. EGS/Appleton Electric
4. Erickson Electrical Equipment Company
5. Hoffman; a Pentair company
6. Hubbell Incorporated; Killark Division
7. Lamson & Sessions; Carlon Electrical Products
8. Milbank Manufacturing Co.
9. Molex; Woodhead Brand
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group
12. RACO; a Hubbell company
13. Robroy Industries
14. Spring City Electrical Manufacturing Company
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries
16. Thomas & Betts Corporation
17. Wiremold/Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

I. Gangable boxes are prohibited.

J. Non-metallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Non-metallic Enclosures:

    a. Material: Plastic.
    b. Finished inside with radio-frequency-resistant paint.

3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1, 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.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Refer to Section 260533 “Raceway and Boxes for Electrical Systems”.

B. Minimum Pathway Size: ¾-inch trade size. Minimum size for optical-fiber cables is 1-inch.

C. Pathway Fittings: Compatible with pathways 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 fittings. Comply with NEMA FB 2.10.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface pathways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of two (2) 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

M. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus ¼ turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Q. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated

on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two (2) supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. ¾-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
3. Install with a maximum of two (2) 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
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 temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041-inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078-inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at 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.

W. 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 top of box unless otherwise indicated.

X. 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 surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

Z. Support boxes of three (3) gangs or more from more than one (1) side by spanning two (2) framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or 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 270528

SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS 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 pathway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53, 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 water-stop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch 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-steel sheet.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052-inch.

b. For sleeve cross-section rectangle perimeter 50 inches or more and one (1) or more sides larger than 16 inches, thickness shall be 0.138-inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) 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.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
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, water-stop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber water-stop collar with center opening to match piping OD.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) of the following:

a. Pre-sealed Systems

2.4 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, twenty-eight (28) day compressive strength.

D. Packaging: Pre-mixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multi-component, silicone-based liquid elastomers that, when mixed, expand

and cure in place to produce a flexible, non-shrinking 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 pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "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 ¼-inch annular clear space between sleeve and pathway 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 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.

E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts

against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 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 water-stop 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 270544

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The scope of work required as part of this project shall include (1) new Telecommunication Room. This area shall include floor mounted 2-post and/or 4-post racks, server cabinets, ladder racking, and wall mounted devices as indicated within the drawing details.

B. Section Includes:

1. Telecommunications mounting devices.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding and bonding.

C. Related Requirements:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches in width.

D. Ladder Cable Tray: A fabricated structure consisting of two (2) longitudinal side rails connected by individual transverse members (rungs).

E. LAN: Local Area Network.

F. RCDD: Registered communications distribution designer.

G. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using seventy-five percent (75%) or less of the plan area of the surface to support cables.

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 equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, 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. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installation of products shall be performed in accordance with the Manufacturer's recommended procedures.

B. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD/NTS and/or Commercial Installer, Level 2.
2. Installation Supervision: Installation shall be under direct supervision of Registered Technician and/or Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD and/or Commercial Installer, Level 2 to perform the on-site inspection.

C. Telecommunications Pathways and Spaces shall comply with TIA-569-C.

D. Grounding shall comply with ANSI-J-STD-607-A.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment racks, cabinets, frames, or cable trays until spaces are enclosed, built-out and weather-tight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.8 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier/Service Providers.

B. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

C. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of the Voice equipment, LAN equipment, Security Equipment, and all other systems that share space within the Telecommunication Equipment rooms.

D. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment 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 when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 PATHWAYS

A. General Requirements: Comply with TIA-569-C.

B. Riser and distribution cables leaving the room to building TRs should be via cable tray, 4-inch conduits or sleeved cores.

C. The exact number of conduits required or size of the cable wireway should be determined based upon the amount of fiber and copper cable that must be supported in each closet and each computer or communications room.

D. Additional conduits or sleeved cores must be included in the design to provide for future growth.

E. All conduits/coring should be kept 6 inches or less from walls whenever construction permits.

F. Cable Support: Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

G. Conduit and Boxes: Refer to Section 260533 “Raceways and Boxes for Electrical Systems”.

2.3 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated,-¾ by 48 by 96 inches.

B. Backboard Paint: Black.

C. Backboards shall be located on a minimum of three (3) walls of the IT Room.

D. Plywood shall comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.4 UPS’

A. The selected manufacturer shall be American Power Conversion Corp., USA in West Kingston, RI. Other manufacturers will be considered, providing equipment meets or exceeds the quality specified and they can provide equipment of the type, size and function required.

B. Each rack shall be provided with one (1) **APC SMT3000RMXLT**, 208-volt Smart-UPS. One (1) UPS per closet shall be provided with **AP9631** network management card with environmental monitoring. All other UPS units in the same closet shall be provided with **AP9630** standard network management card.

2.5 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products as indicated on Drawings or comparable ones by one (1) of the following:

1. Chatsworth Products, Inc.
2. Great Lakes
3. Hubbell
4. Middle Atlantic

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Install underground pathways complying with recommendations in TIA-569-C.

C. Install underground entrance pathway complying with Section 260533 "Raceway and Boxes for Electrical Systems”.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. All conduits etc., passing through fire rated floors, walls, and partitions, shall have the space between the raceways, sleeves, and all penetrations filled with a reusable firestopping material.

3.4 GROUNDING

A. Comply with ANSI-J-STD-607-A.

B. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. The grounding system must be intentional, visually verifiable, and adequately sized to handle expected currents safely. The grounding system shall be designed and installed in accordance with the NECA/BICSI 607-2011 Standard for Bonding and Grounding Planning for commercial buildings.

E. Telecommunications Grounding Busbar:

1. Telecommunications Grounding Busbars or TGBs are located in Telecommunications Rooms (TR) to provide grounding for racks, enclosures, and equipment in these spaces.
2. The length of this bar is determined by the amount of connections that will be made to it, but the minimum thickness is ¼-inch and the minimum width is 2 inches.
3. TGBs shall be electotin plated for reduced contact resistance.
4. The TGB shall be mounted using minimum 2-inch insulated standoffs.
5. All metal racks, enclosures, equipment, and cable pathways entering these spaces shall be bonded to the TGB using minimum #6 AWG wire and crimp or weld-on lugs.
6. All exposed/accessible building steel within these spaces shall be bonded to the TGB using minimum #6 AWG wire and crimp or weld-on lugs.
7. TGBs shall be assigned a unique identification and permanently labeled.

F. Rack Grounding:

1. Electrical continuity throughout each rack or cabinet is required to minimize safety risks. The racks shall be assembled using paint-piercing grounding washers (Panduit Part no. **RGW**, or approved substitute) and antioxidant (per the recommendations of the manufacturer). An electrostatic discharge port kit (Panduit **RGESD**, or approved substitute) shall be placed on the rack (on the right side when facing the rack) at 40 inches above the floor. All bonding connections to the rack shall be made with thread-forming screws (Panduit Part no. **RGTS**, or approved substitute), or the threads must be cleaned of all paint or residue (per the NEC).
2. In locations with multiple racks, the rack shall be connected to the common bonding network with a #6 AWG conductor and a copper compression HTAP. In locations with single racks, a #6 AWG conductor to the busbar is sufficient. The common bonding network is a 2 AWG continuous conductor placed below or above the racks. Refer to NECA/BICSI 607-2011 for design recommendations.

G. Rack Compression Fitting:

1. Lugs and HTAPs must be manufactured of tin-plated copper and fastened via irreversible compression (crimped). Lugs shall have spacing to fit Panduit **GB** series predrilled busbars and a window to allow for inspection of the crimp. HTAPs shall be contained in clear covers that allow inspection of the die marks to ensure that the proper die was used.
2. Approved Lugs:

    a. Burndy; **YAZ series**
    b. CPI
    c. Electric Motion Company; **CCL Series**
    d. Panduit; **LCC or LCCX series**

3. Approved HTAPS:

    a. Burndy; **YH series** (when used with clear covers)
    b. Panduit; **HTWC series**

H. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 260553 "Identification for Electrical Systems." Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. Backboard and Equipment Racks:

1. Backboards and equipment racks shall be labeled by the Contractor identifying the Telecommunication Room. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications closet. For example, TR1-A would be the first rack in TR1.
2. Character height shall be 1-inch (minimum).

C. See Section 271500 "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2, Class 3, or Class 4 level of administration including optional identification requirements of this standard.

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 271300 - COMMUNICATIONS BACKBONE 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. Pathways.
2. UTP cable.
3. Multi-mode: OM3, 50/125 micrometer, 24-strand, armored optical fiber cabling.
4. Single mode optical fiber cabling, 24-strand, armored optical fiber cabling.
5. Coaxial cable.
6. Cable connecting hardware, patch panels, and cross-connects.
7. Cabling identification products.
8. Testing procedures.

B. Related Sections:

1. Division 271100 Section "Communications Equipment Room Fittings".

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between telecommunications equipment rooms and the rest of the facility for the voice/data cabling systems.

B. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patching or jumpers used for backbone-to-backbone cross-connection to service provider equipment.

C. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
4. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

a. Vertical and horizontal offsets and transitions.
b. Clearances for access above and to side of cable trays.
c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
d. Load calculations shall show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

D. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and field-testing program development by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall always be present when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications:

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.2 and TIA-568-C.3, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-C.

D. Grounding: Comply with ANSI-J-STD-607-A.

E. 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.

2.2 PATHWAYS

A. General Requirements: Comply with TIA-569-C.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2½ inches deep.

2.3 UTP CABLE

A. Description: Voice Backbone Cabling.

B. Cable shall be 100-ohm, 100 -pair UTP, formed into 25-pair binder groups, plenum rated cable.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA-568-C.2 for performance specifications.
3. Comply with TIA-568-C.2, Category 5E.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include and are limited to the following:

1. Belden
2. Berk-Tek
3. Superior Essex

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include and are limited to the following:

1. Belden
2. Hubbell Premise Wiring
3. Leviton

B. General Requirements for Cable Connecting Hardware: Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 5E. Provide blocks for the number of cables terminated on the block, plus twenty-five percent (25%) spare. Integral with connector bodies, including plugs and jacks where indicated.

D. 100-pair, 110-style CAT 5E 19-inch rack mounted patch panels to allow for cross-connection from voice origination (PBX) to workstations via CAT 5E patch cords.

E. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One (1) for each conductor in assigned cables.

F. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One (1) for each four-pair UTP cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.

G. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

2.5 OPTICAL FIBER CABLE

A. Description: Data Backbone Cabling.

B. 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. Belden
2. Berk-Tek
3. Superior Essex

C. Description: Multi-mode, OM3, 50/125, 24-fiber, non-conductive, tight buffer, armored optical, plenum rated, fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAC-A-2003, Detail Specification for 850-nm Laser-Optimized, 50-µm Core Diameter/125-µm Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers for detailed specifications.
4. Maximum Attenuation: Conform to ANSI/TIA-455-78-B-2002, Optical Fibers Part 1-40: Measurement Methods and Test Procedures – Attenuation: 2.50 dB/km at 850 nm; 1.0 dB/km at 1300 nm.
5. Minimum Modal Bandwidth, Conform to TIA-492-AAAC: 1500 MHz-km at 850 nm; 500 MHz-km at 1300

D. Description: Single mode, 24-fiber, nonconductive, tight buffer, armored optical, plenum rated, fiber cable.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492-CAABxx for detailed specifications.
4. Maximum Attenuation: 1.0 dB/km at 1340 nm; 1.0 dB/km at 1550 nm.

E. Jacket:

1. Jacket Color: Single mode, aqua; multi-mode, orange.
2. Armored fiber jacket required. Inter-locking armor shall be made of aluminum.
3. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
4. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.6 OPTICAL FIBER CABLE HARDWARE

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. Belden
2. Hubbell Premise Wiring
3. Legrand- Ortronics
4. Leviton

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One (1) for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2, TIA-604-3-A, and TIA-604-12. Comply with TIA-568-C.3.
2. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) of the following:

1. Alpha Wire Company
2. Belden Inc.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka Cableteq USA

B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and sixty percent (60%) aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

D. NFPA and UL compliance listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) of the following:

1. Emerson Network Power Connectivity Solutions
2. Leviton Commercial Networks Division
3. Siemon Co. (The)

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including etching, label stocks, laminating adhesives, and inks used by label printers.

B. Labeling of all cable is described within the drawing documents.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA-568-C.2.

C. Factory test UTP cables according to TIA-568-C.2.

D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA-568-C.3.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Each Fiber Optic Termination Panel shall be clearly labeled indicating (1) the destination(s) of the cable(s) and (2) fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and J-hooks except where cable trays are required in Drawings. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

C. Pre-terminated fiber optic cabling will be accepted. Manufacturer shall be approved upon product submission.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA-569-C.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA-569-C for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with TIA-568-C.2.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist UTP cables more than ½-inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA-568-C.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in non-metallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2½ inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-C.

C. Comply with BICSI ITSIMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: Class 2.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Clearly label all Data Patch Panels via etching, as indicating the Telecommunication Room Number, The Data Patch Panel letter designation and the Data Port Number on the Data Patch Panel Ports 1 through 48. Each Telecommunication Room shall start with Data Patch Panel ‘A’ and continue through the Alphabet.

D. See Section 271500 "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration including optional identification requirements of this standard.

E. Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable and asset management software.

F. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

G. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

H. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. All fiber optic backbone and copper (inter-building, riser and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g. Equipment Room or Telecommunications Room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.
7. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

I. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with

color-coding for pin assignments and inspect cabling connections for compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Optical Fiber Cable Tests:

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Link End-to-End Attenuation Tests:

        1) Multimode backbone link measurements: Test at 850 and 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
        2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.3.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271323

SECTION 271500 - COMMUNICATIONS HORIZONTAL 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. UTP cabling.
2. Pathways.
3. Multi-user telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling system identification products.
7. Cable management system.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. MUTOA: Multi-user telecommunications outlet assembly, a grouping in one (1) location of several telecommunications' outlet/connectors.

H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

I. RCDD: Registered Communications Distribution Designer.

J. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics, including the following:

a. Cross-connects.
b. Patch panels.
c. Patch cords.

4. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall always be present when Work of this Section is performed at Project site.

3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two (2) telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one (1) transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

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.

D. Grounding: Comply with J-STD-607-A.

2.3 UTP CABLE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) of the following:

1. ADC
2. Belden Inc.
3. Berk-Tek; a Nexans company
4. CommScope, Inc.
5. Draka Cableteq USA.
6. Genesis Cable Products; Honeywell International, Inc.
7. Mohawk; a division of Belden Networking, Inc.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand
10. 3M Communication Markets Division
11. Tyco Electronics Corporation; AMP Products

B. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG.
    b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    d. Communications, Limited Purpose: Type CMX.

2.4 UTP CABLE HARDWARE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one (1) of the following:

1. ADC
2. American Technology Systems Industries, Inc.
3. Belden Inc.
4. Dynacom Inc.
5. Hubbell Premise Wiring
6. Leviton Commercial Networks Division
7. Molex Premise Networks; a division of Molex, Inc.
8. Panduit Corp.
9. Siemon Co. (The)
10. Tyco Electronics Corporation; AMP Products

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus twenty-five percent (25%) spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One (1) for each conductor in assigned cables.

E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One (1) for each four-pair UTP cable indicated.

F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

G. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.5 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit
e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inches thick.

a. Trough Cable Trays: Nominally 6 inches wide.
b. Ladder Cable Trays: Nominally 18 inches wide, and a rung spacing of 12 inches.

D. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems."

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2½ inches deep.

2.6 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Multi-port-connector assemblies mounted in single faceplate.

1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.

a. Flush mounting jacks, positioning the cord at a 45-degree angle.

3. Legend: Machine printed in the field, using adhesive-tape label or Snap-in, clear-label covers and machine-printed paper inserts.

2.7 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

2.8 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. MUTOA shall not be used as a cross-connect point.
5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:

    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for UTP at least 49 feet from communications equipment room.

6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than ½ inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in non-metallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2½ inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRESTOPPING

A. Comply with TIA-569-B, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

C. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.

E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6**,** marking of outlets, cover plates, outlet/connectors, and patch panels
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568- B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. UTP Performance Tests:

    a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

        1) Wire map.
        2) Length (physical vs. electrical, and length requirements).
        3) Insertion loss.
        4) Near-end crosstalk (NEXT) loss.
        5) Power sum near-end crosstalk (PSNEXT) loss.
        6) Equal-level far-end crosstalk (ELFEXT).
        7) Power sum equal-level far-end crosstalk (PSELFEXT).
        8) Return loss.
        9) Propagation delay.
        10) Delay skew.

6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

    a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
    b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 271500

SECTION 283100 - INTEGRATED SECURITY 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. Intrusion detection with communication links to perform monitoring, alarm, and control functions to existing Honeywell Vista system.
2. Video surveillance additions to existing Avigilon Unity 8 system with Avigilon Cameras (match existing line and models).
3. Access control additions to existing DSX system.
4. Integration of other electronic and electrical systems and equipment.
5. Installation of all equipment in this section shall be by Security Specialist in Stamford, CT or approved equal by owner.

B. Related Sections:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for power cabling between master control units and field-mounted devices and control units.
2. Section 271300 "Communications Copper Backbone Cabling" for Category 6 backbone (riser-rated) cabling.
3. Section 271500 "Communications Copper Horizontal Cabling" for Category 5e, 6, and 7 horizontal (general use, riser-, and plenum-rated) cabling.

1.3 DEFINITIONS

A. CCTV: Closed-circuit television.

B. PIR: Passive infrared.

C. RFI: Radio-frequency interference.

D. UPS: Uninterruptible power supply.

E. Control Unit: System component that monitors inputs and controls outputs through various circuits.

F. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.

G. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.

H. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.

I. Standard Intruder: A person who weighs 100 pounds or less and whose height is 60 inches or less; dressed in a long-sleeved shirt, slacks, and shoes.

J. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

K. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.

L. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.4 ACTION SUBMITTALS

A. Product Data: Components for sensing, detecting, access control, video surveillance, systems integration, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

1. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection and for systems integration. Include designation of devices connected by raceway, raceway type and size, and type and size of wire and cable fill for each raceway run.
2. UPS: Sizing calculations.
3. Device Address List: Coordinate with final system programming.
4. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
5. Details of surge-protection devices and their installation.
6. Sensor detection patterns and adjustment ranges.

B. Design Data: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, intrusion detection systems integrator and testing agency.

B. Field quality-control reports.

1. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

C. Product Warranty: Sample of special warranty.

D. Field Test Reports: Test plan and report defining all tests required to ensure that system meets technical, operational, and performance specifications within sixty (60) days of date of Contract award.

E. Evaluation Reports: Examination reports documenting inspections of substrates, areas, and conditions.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.
2. Master control-unit hardware and software data.

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. Intrusion Detection Devices: Furnish quantity equal to five percent (5%) of the number of units of each type installed, but no fewer than one (1) of each type.
2. Security Fasteners: Furnish no fewer than one (1) box for every fifty (50) boxes or fraction thereof, of each type and size of security fastener installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. An employer of workers, at least one of whom is a Certified Alarm Technician, Level 1.
2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Layout Responsibility: Preparation of Shop Drawings and field testing program development by an RCDD Technician.
4. Installation Supervision: Installation shall be under the direct supervision of Level 2 Commercial Installer, who shall be present at all times when Work of this Section is performed at Project site.

B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier and Installer who has completed systems integration work for installations 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.

1. At least one (1) of whom is a Certified Systems Integrator (Security Specialist or approved equal).

1.9 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Master Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F and a relative humidity of twenty to eighty percent (20-80%), non-condensing.
2. Interior, Controlled Environment: System components, except master control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambients of 36 to 122 deg F dry bulb and twenty to ninety percent (20-90%) relative humidity, non-condensing.

3. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambients of 0 to 122 deg F dry bulb and twenty to ninety percent (20-90%) relative humidity, non-condensing.
4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambients of minus 30 to plus 122 deg F dry bulb and twenty to ninety percent (20-90%) relative humidity, condensing. Comply with UL 294 and UL 639 for outdoor-use equipment. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 105 mph.
5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings shall be rated, listed, and installed according to NFPA 70.

1.10 WARRANTY

A. Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Provide manufacturer’s standard warranty from the date of substantial completion, or a one (1) year warranty, from the date of substantial completion, whichever is greater.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Description: Hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.

C. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.

D. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

E. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.

2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
5. Protected Zone Test: Initiate operational test of a specific protected zone.
6. System Test: Initiate system-wide operational test.
7. Print reports.

F. Automatic Control of Related Systems: Alarm or supervisory signals from certain intrusion detection devices control the following functions in related systems:

1. Switch selected lights.
2. Open a signal path between certain intercommunication stations.
3. Shift sound system to "listening mode" and open a signal path to certain system speakers.
4. Switch signal to selected monitor from CCTV camera in vicinity of sensor signaling an alarm.

G. Response Time: Two seconds between actuation of any alarm and its indication at master control unit.

H. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

I. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be pre-set up to a year in advance. Manual secure-access control stations shall override programmed settings.

J. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

C. FM Global Compliance: FM-Approved and -labeled intrusion detection devices and equipment.

D. Comply with NFPA 70.

E. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Door hardware specified in Section 087100 "Door Hardware."
2. Lighting controls specified in Section 260923 "Lighting Control Devices."

3. Intercom and program systems (match existing components).
4. Access control system (match existing DMP panels & components).
5. Fire alarm system specified in Section 283111 "Digital, Addressable Fire-Alarm System."
6. Video surveillance system specified in this specification (Avigilon Unity 8).

F. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

G. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

H. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

I. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

J. Anti-masking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

K. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

2.3 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping non-corrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Exterior Electronics: NEMA 250, Type 4X, stainless-steel.

D. Corrosion Resistant: NEMA 250, Type 4X, stainless-steel.

E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

A. System shall match manufacturers of existing systems.

B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.

C. Key-Operated Switch: Change protected zone between secure and access conditions.

2.5 DOOR AND WINDOW SWITCHES

A. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to eighty percent (80%) of switch capacity. Bias magnet and minimum of two (2) encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.

B. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

C. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounted magnet and floor-mounted switch unit.

2.6 DURESS-ALARM SWITCHES

A. Description: A switch with a shroud over the activating lever that allows an individual to covertly send a duress signal to master control unit, with no visible or audible indication when activated. Switch shall lock in activated position until reset with a key.

1. Minimum Switch Rating: 50,000 operations.
2. Foot Rail: Foot activated, floor mounting.
3. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface.

2.7 MASTER CONTROL UNIT

A. System is existing; all new components shall be manufactured by same manufacturer as the existing.

B. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.

1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
2. Include a real-time clock for time annotation of events on the event recorder and printer.
3. Addressable initiation devices that communicate device identity and status.
4. Control circuits for operation of mechanical equipment in response to an alarm.

C. Construction: Wall mounted equipment rack, modular, with separate and independent alarm and supervisory system modules. Arrangements that require removal of field wiring for module replacement are unacceptable.

D. Comply with UL 609.

E. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: LCD, three line(s) of forty (40) characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event.

Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.

4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:

    a. Acknowledge alarm.
    b. Silence alarm.
    c. System reset.
    d. LED test.

6. Timing Unit: Solid state, programmable, three hundred sixty-five (365) days.
7. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.
8. Alarm Indication: Audible signal sounds and an LED lights at master control unit identifying the addressable detector originating the alarm. Annunciator panel displays a common alarm light and sounds an audible tone.
9. Alarm activation sounds a bell or siren and strobe.

F. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a twenty percent (20%) increase in load.

G. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1-inch-high. Identify, with permanent labels, individual components and modules within cabinets.

H. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line. Comply with UL 1635.

I. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

2.8 AUDIBLE AND VISUAL ALARM DEVICES

A. Bell: 10 inches in diameter, rated to produce a minimum sound output of 84 dB at 10 feet from master control unit.

1. Enclosure: Weather-resistant steel box equipped with tamper switches on cover and on back of box.

B. Klaxon Weatherproof Motor-Driven Hooter: UL listed, rated to produce a minimum sound output of 120 dB at 3 feet, plus or minus 3 dB, at a frequency of 470 Hz. Rated for intermittent use: 2 minutes on and 5 minutes off.

1. Designed for use in industrial areas and in high-noise, severe-weather marine environments.

C. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.

1. Light Output: 115 cd, minimum.
2. Flash Rate: 60 per minute.

2.9 VIDEO SURVEILLANCE COMPONENTS

A. All components of the video surveillance system expansion must be compatible and listed for operation with the existing Avigilon Unity 8 system.

B. IP Cameras shall be manufactured by Avigilon subject to all other requirements of this specification. Series, matches Greenwich standards.

1. All associated devices and/or licensing are required to obtain a fully functional system, as mandated by this bid specification.
2. All camera locations MUST be field verified with the Owner prior to start of project. Architectural drawings are for approximation purposes only. Additional charges will not be allowed for installation in areas not reviewed or approved by the Owner.
3. Interior fixed color camera: 6 Megapixel, H.264 HDSM, multi-stream with polycarbonate vandal resistant housing.

2.10 ACCESS CONTROL COMPONENTS

A. All components of the access control system expansion must be compatible and listed for operation with the existing DMP panels.

1. Card readers shall match the style and configuration of the existing system.
2. Contractor is responsible for surveying the existing system capacity and furnishing all components required for the expansion shown. Expansion modules for the added card readers shall be assumed. All necessary programming of the existing system shall be provided.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

A. Integrate intrusion detection system with the following systems and equipment:

1. Electronic door hardware.
2. Network lighting controls.
3. Intercommunications and program systems.
4. Public address and mass notification systems.
5. Access control.
6. Fire-alarm system.
7. Perimeter security system.
8. Video surveillance.

3.3 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

C. Connecting to Existing Equipment: Verify that existing video surveillance and access control systems are operational before making changes or connections.

1. Connect new equipment to existing control panels in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the Supervising Station.
3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

3.4 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Section 270528 "Pathways for Communications Systems," except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be ½-inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to

sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
2. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable, according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
4. Data and Television Signal Transmission Cables: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

F. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

G. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products per Owner’s standards.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements per Owner’s standards.

B. Install instructions frame in a location visible from master control unit.

3.6 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.

3.7 FIELD QUALITY CONTROL

A. Pre-testing: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

1. Report of Pre-testing: After pre-testing is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. 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.

C. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

D. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation."

E. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within twelve (12) months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three (3) visits to Project during other-than-normal occupancy hours for this purpose.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the intrusion detection system. Comply with documentation provisions in NFPA 731, Ch. 4, "Documentation and User Training."

END OF SECTION 283100

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM 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. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Carbon monoxide detectors.
6. Notification appliances.
7. Remote annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. Radio alarm transmitter.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 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 and the unit will be fully operational after the seismic event."

1.6 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.

b. NICET-certified fire-alarm technician, Level III and/or Level IV minimum.
c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Seismic Qualification Certificates: For fire-alarm control unit, 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.

G. Field quality-control reports.

H. Operation and Maintenance Data: For fire-alarm systems and components to include in operation and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

I. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

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. NFPA Certification: Obtain certification according to NFPA 72

1.8 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Architect and Construction Manager no fewer than five (5) days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Architect and Construction Manager written permission.

1.9 SEQUENCING AND SCHEDULING

A. The system alarm operation subsequent to the alarm activation of any manual pull station, sprinkler flow switch, hood suppression system or automatic detection device is to be in accordance with Article 2.2 of this specification.

B. Alarm Verification:

1. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel will reset the activated detector and wait for a second alarm activation.
2. If, within 1 minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously.
3. If no second alarm occurs within one minute the system shall resume normal operation.
4. The Alarm Verification is to operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately.
5. The alarm verification operation is to be selectable by addressable device.
6. The control Unit shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this smoke verification tally reach a pre-programmed number, a trouble condition shall occur.

C. Supervisory Service:

1. The control panel shall have a dedicated supervisory service condition and a dedicated supervisory service acknowledge switch.
2. Activating the Supervisory Service Acknowledge Switch will silence the supervisory audible signal while maintaining the Supervisory Service listing on indicating the tamper contact is still in the off-normal state.
3. Restoring the valve to the normal position shall cause the Supervisory Service indication to reset thus indicating restoration to normal position.
4. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse thus indicating restoration to normal position.
5. Activating the Supervisory Service Acknowledge Switch will silence the audible signal and restore the system to normal.

D. A manual evacuation switch shall be provided to operate system alarm indicating appliances. Other control circuits shall not be activated. However, an actual alarm shall be processed as described previously.

E. Activation of an auxiliary bypass switch shall override the automatic functions either selectively or throughout the system.

F. Alarm and trouble conditions shall be immediately displayed on the control panel front.

1.10 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two (2) years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide thirty (30) days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.11 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 for Strobe Units: Quantity equal to ten percent (10%) of amount installed, but no fewer than one (1) unit.
2. Smoke Detectors and Heat Detectors: Quantity equal to ten percent (10%) of amount of each type installed, but no fewer than one (1) unit of each type.
3. Detector Bases: Quantity equal to two percent (2%) of amount of each type installed, but no fewer than one (1) unit of each type.
4. Keys and Tools: One (1) extra set for access to locked and tamper-proofed components.
5. Audible and Visual Notification Appliances: One (1) of each type installed.
6. Fuses: Two (2) of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All new fire alarm components shall be by the same manufacturer as the existing system (**Farenhyt IFP 2000**), no exceptions.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one (1) or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow and pressure.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm visual notification appliances until extinguished by the Alarm Reset Switch.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Release fire and smoke doors held open by magnetic door holders.
5. Activate voice/alarm communication system until silenced by the alarm silence switch or individual circuit switch at the control panel.
6. From an interface with the local systems, the fire alarm system shall mute the sound/paging systems during an alarm.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Activate emergency shutoffs for gas and fuel supplies.
11. Record events in the system memory.

C. Supervisory signal initiation shall be by one (1) or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.

3. Generator general alarm switch.
4. Carbon monoxide detector.

D. System trouble signal initiation shall be by one (1) or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Low-air-pressure switch operation on a dry-pipe or pre-action sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two (2) lines of forty (40) characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

a. Initiating Device Circuits: Style B.
b. Notification Appliance Circuits: Style Y.
c. Signaling Line Circuits: Style 3.
d. Install no more than fifty (50) addressable devices on each signaling line circuit.

2. Serial Interfaces: Two (2) RS-232 ports for printers.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Sound general alarm if the alarm is verified.
4. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Notification Appliance Circuit: Operation shall sound with an initial alert tone, followed by a pre-recorded emergency voice message of approximately 15 seconds, followed by a repeating alarm “whoop” tone.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals and supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed eighty percent (80%) of the power-supply module rating.

J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Vented, wet-cell pocket, plate nickel cadmium.
2. System shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of 60 hours with 5 minutes of alarm operation at the end of this period.

K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key operated switch.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
7. Remote Test Switch: With keyed switch and LED indicator.

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 CARBON MONOXIDE DETECTORS

A. General Requirements for System-type Carbon Monoxide Detectors:

1. Comply with UL 2075 and UL 2034; operating at 24-V dc, nominal.

2. Electrochemical sensing technology.
3. Detectors shall be two-wire type.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

B. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

2.8 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch high letters on the lens.

1. Rated Light Output: 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

D. Voice/Tone Notification Appliances (Speakers):

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.
4. Mounting: Flush.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two (2) telephone lines and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on one (1) of the lines is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Control panel and NAC panel shall receive 120 VAC power via a dedicated branch circuit protected in accordance with the National Electric Code.

1. The system shall support one hundred percent (100%) of notification and initiating devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
2. System shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of 60 hours with 5 minutes of alarm operation at the end of this period. Any system cabinets furnished with independent power supplies and/or batteries shall also meet these requirements.
3. System shall automatically transfer to standby batteries upon power failure. All battery charging and recharging operations shall be automatic.

4. All circuits requiring system operating power shall be 24 VDC and shall be individually fused or equivalently protected at the control unit.
5. The incoming power to the system shall be supervised so that any power failure must be audibly and visibly indicated at the control unit and the annunciator. A green "power on" LED shall be displayed continuously while incoming power is present.
6. If a “LOW BATTERY” condition is left unattended a second stage “DEPLETED BATTERY” trouble condition shall be audibly and visibly reported at the control unit indicating the batteries are below the listed system operating voltage.
7. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visibly indicated at the control unit and the annunciator.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on wall with tops of cabinets not more than 72 inches above the finished floor.

C. Smoke- or Heat-Detector Spacing:

1. Smooth ceiling spacing shall not exceed 30 feet.
2. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
3. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

E. Carbon Monoxide Detectors: Comply with NFPA 720. Install per manufacturer’s instructions and as remotely located from the heating appliance as possible (within room). Detectors shall be individually addressablly monitored and programmed to initiate a supervisory signal.

F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

J. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.
2. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
3. Supervisory connections at valve supervisory switches.
4. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. 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.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents,

Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test carbon monoxide detectors in accordance with NFPA 720.
4. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
5. Test audible appliances for the private operating mode according to manufacturer's written instructions.
6. Test visible appliances for the public operating mode according to manufacturer's written instructions.
7. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One (1) year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

LIMITED NESHAP PRE-RENOVATION HAZARDOUS BUILDING MATERIALS SURVEY REPORT – SECURITY ENTRYWAY PROJECT

for

Eastern Middle School
51 Hendrie Avenue
Riverside, Connecticut 06878

Prepared For:

David J. Stein, AIA
Principal
Silver/Petrucelli + Associates
3190 Whitney Avenue
Building 2
Hamden, CT 06518-2340

Prepared By:

Langan CT, Inc.
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Matthew A. Myers
Senior Project Manager

6 November 2025
140327001

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ACRONYMS

US EPA	United States Environmental Protection Agency
AHERA	Asbestos Hazard Emergency Response Act
OSHA	Occupational Safety and Health Administration
CFR	Code of Federal Regulation
NESHAP	National Emission Standards for Hazardous Air Pollutants
HUD	Housing and Urban Development
CT DPH	Connecticut Department of Public Health
CTDEEP	Connecticut Department of Energy and Environmental Protection
RCRA	Resource Conservation and Recovery Act
PLM	Polarized Light Microscopy
TEM	Transmission Electron Microscopy
ACM	Asbestos Containing Materials
HBM	Hazardous Building Materials
LBP	Lead-Based Paint
PCB	Polychlorinated Biphenyls
SF	Square Feet
LF	Linear Feet
ppm	Parts per million
mg/cm^2	Milligrams per square centimeter
XRF	X-ray Fluorescence
TCLP	Toxicity Characteristic Leaching Procedure
AAS	Atomic Absorption Spectrometry

1.0 INTRODUCTION

Langan CT, Inc. (Langan) prepared this revised limited National Emissions Standards for Hazardous Air Pollutants (NESHAP) Pre-Renovation Hazardous Building Materials (HBM) Survey Report on behalf of the Town of Greenwich and Silver/Petrucelli + Associates to identify hazardous building materials that may exist at the main entryway of Eastern Middle School, 51 Hendrie Avenue, Riverside, Connecticut. The two-story school was constructed in 1968 and is approximately 108,000 square-feet (SF). The objectives of this survey/report is to identify the presence or absence of accessible asbestos-containing materials (ACM), lead-based paint (LBP), suspect assumed Polychlorinated biphenyl (PCB) containing sealant compounds and universal waste so these materials can be properly quantified and assessed in support of planned renovation of the main entryway.

Details pertaining to the building subject to this survey are summarized in the following table.

PROJECT INFORMATION

Client Name:	Silver/Petrucelli + Associates 3190 Whitney Avenue Building 2 Hamden, CT 0518-2340	Property Visit Date:	4 November 2025
Professional's Project #:	140327001	Construction Dates:	1968
Consultant's Project Manager:	Matthew A. Myers	No. Buildings:	One
Phone No.:	203-562-5571	No. of Stories:	Two
Email:	mmyers@langan.com	Bldgs. Gross Footage:	108,000 Square Feet
Property Address:	51 Hendrie Avenue		
Property Town, State:	Riverside, Connecticut	Property Use:	Public Middle School

The following sections summarize the HBM findings for the small portion of the building surveyed.

2.0 ASBESTOS-CONTAINING MATERIALS

Terminology

Suspect Asbestos-Containing Materials

Asbestos was historically used in certain types of construction and building materials. Until a material is examined by using polarized light microscopy (PLM) or a similar technique, the building material is considered as a suspect asbestos-containing material. A few examples of these materials include wall and ceiling plasters, sheetrock/taping compound, flooring materials, ceiling panels, thermal system insulation, fireproofing insulation, adhesives, roofing materials, damp-proofing/waterproofing materials, caulking and glazing compounds, etc. Any suspect ACM and/or building material of unknown asbestos content should be assumed to be an asbestos containing material and handled and disposed of accordingly. Demolition, renovation, maintenance or daily activities should not disturb building materials that are found to contain asbestos, assumed to contain asbestos or that have not been tested for possible asbestos content.

Asbestos–Containing Material

A material with an asbestos concentration greater than 1% by weight is considered an ACM by the United States Environmental Protection Agency (EPA). Thus, a material which contains asbestos in concentrations greater than 1% by weight is considered "positive" while a material that does not contain asbestos or asbestos is detected in concentrations less than 1% by weight is considered "negative". The Connecticut Department of Public Health (CT DPH) revised the definition of an asbestos-containing material to be a concentration equal to or greater than 1% by weight. However, the Occupational Safety and Health Administration (OSHA) considers any amount of asbestos as regulated and some landfills/states consider building materials containing less than 1% asbestos as regulated asbestos-containing waste.

Regulatory Guidelines and Requirements

Federal

In accordance with the Clean Air Act (CAA), the U.S. Environmental Protection Agency established the National Emission Standards for hazardous Air Pollutants to protect the public from exposure to airborne pollutants. Asbestos was one of the air pollutants, which was addressed under the NESHAP 40 Code of Federal Regulations (CFR) Part 61. The purpose of the asbestos NESHAP regulations is to protect the public health by minimizing the release of

asbestos when facilities, which contain ACM, are being renovated or demolished. EPA is responsible for enforcing regulations related to asbestos during renovation and demolition activities, however, the CAA allows the EPA to delegate this authority to state and local agencies. Even after EPA delegates responsibility to a state or local agency, EPA retains the authority to oversee agency performance and to enforce NESHAP regulations as appropriate. OSHA considers any amount of asbestos to be regulated.

State

Asbestos in Connecticut is regulated by the State of Connecticut Department of Public Health, under Standards for Asbestos Abatement – Section 19a-333a-1 through 16 of Regulations of Connecticut State Agencies (RCSA) and Licensing and Training Requirements for Persons Engaged in Asbestos Abatement and Asbestos Consulting Services – Section 20-440-1 through 9 and Section 20-441 of RCSA.

Asbestos Survey

During this survey, suspect ACM were separated into three US EPA categories. These categories are: thermal system insulation (TSI), surfacing materials, and miscellaneous materials. TSI includes all materials used to prevent heat gain or loss or water condensation on mechanical systems. Typical examples of TSI are boiler, duct and tank insulation, pipe and pipe fitting insulation. Surfacing materials are sprayed, troweled or otherwise applied to an existing surface and common uses are fireproofing, decorative and acoustical plaster applications. Miscellaneous materials include all ACM not listed as TSI or surfacing and include: flooring materials, ceiling tiles, adhesives, transite cement board, sink undercoating, gypsum board/taping and joint compounds, cove base materials, caulking and glazing compounds, damp-proofing/tars/mastics, roofing materials and other materials. State of Connecticut DPH licensed asbestos inspectors Hilton Hernandez (#000424) and Matthew Myers (#000041) performed the limited survey.

ACM Results Summary

Bulk sampling results are included as Tables 1 and 2 below. Analytical asbestos laboratory data can be found in Appendix A.

As required by EPA and CT DPH, samples were analyzed by individual layers (e.g. floor tile & the associated mastic were analyzed as two separate samples, rough and finish coat plasters, etc.). Bulk samples of suspect ACM were analyzed using the PLM analytical methodology in

accordance with EPA Protocol 600/R-93/116 and possibly by PLM Point Count. Additional analysis of non-friable organically bound (NOB) materials (e.g. mastics, etc.) using NOB and transmission electron microscopy (TEM) was not performed. The samples were analyzed by EMSL Analytical, Inc. of Meriden, Connecticut, accredited by the National Voluntary Laboratory Program (NVLAP) and American Industrial Hygiene Association (AIHA).

Utilizing the EPA and CT DPH protocols and criteria, the following materials **were determined to be ACM:**

Table 1 – Summary of Asbestos-Containing Materials

Material	Location	% Asbestos and Sample ID	Estimated Quantity of ACM
Pipe and Pipe Fitting Insulation – Thermal System Insulation	Main Entryway Above Suspended Ceiling Tiles from Perimeter Doors to Interior Corridor Entryway Doors	ACM 3% Amosite 3% Crocidolite 60% Chrysotile 110409A 110410A	20 Linear Feet

Utilizing the EPA and CT DPH protocols and criteria, the following materials **were determined to be non-ACM:**

Table 2 – Summary of Non-Asbestos-Containing Materials

Material	Location	Sample ID
"Newer" Interior Door Window Glazing Compound – Miscellaneous Material	Main Entryway – Five Wood Doors	110401A,B
Terrazzo Flooring – Miscellaneous Material	Main Entryway	110402A,B
2'x2' Ceiling Tile – Miscellaneous Material	Main Entryway	110403A,B
Wood Wall Panel Adhesive (Black) – Miscellaneous Material	Main Entryway	110404A,B
Cove Base and Adhesive – Miscellaneous Materials	Main Entryway	110405A,B 110406A,B

Material	Location	Sample ID
Block Wall and Mortar – Miscellaneous and Surfacing Materials	Main Entryway	110407A,B 110408A-C
Fire Door Insulation – Miscellaneous Material	Main Entryway – Five Wood Doors	110411A,B

DISCLAIMERS: Reasonable care was taken to identify all suspect accessible asbestos containing materials through visual inspection and limited destructive sampling techniques. However, it is not feasible to uncover all materials that may exist. Additional materials may need to sampled after the building has been vacated and/or during the selective demolition/renovation process. Some locations/materials were not sampled during this survey due to occupancy, location and damage required to inspect certain materials/areas.

Interior Hidden Materials - Additional suspect asbestos-containing materials may be discovered during selective demolition and/or renovation activities despite the inspectors investigating representative areas during the survey. Additional asbestos containing materials may be found:

- Underneath terrazzo flooring;
- Vermiculite, pipe insulation, transite cement board and other materials behind/inside walls, ceilings and chases; and
- Roofing materials (not currently in scope of work).

3.0 LEAD-BASED PAINT XRF SCREENING

A limited lead-based paint XRF (X-ray Fluorescence) screening survey was performed throughout the main entryway by Matthew Myers, a CT DPH licensed lead inspector (CT license #000191). LBP was identified exceeding the HUD/EPA action level of equal to or greater than 1.0 mg/cm^2 in the materials listed below. Metal materials painted in lead-based paint may be recycled. See Appendix B for XRF field data sheets.

Table 3 – XRF Lead-Based Paint Screening Results (>1 mg/cm^2)

Sample Number	Component	Substrate	Color	Test Location	Total Lead mg/cm^2	Results
8	Handrail/ Guardrail	Metal	Black	Main Entryway Interior Stairwell	3.1	Positive
9	Baseboard /Sideboard	Metal	Black	Main Entryway Interior Stairwell	2.1	Positive

Contractors should be aware that OSHA has not established a level of lead in a material below which 29 CFR 1926.62 does not apply. Contractor shall comply with exposure assessment criteria, interim worker protection and other requirements of the regulation as necessary to protect workers and occupants/residents.

The information in this report does not constitute a comprehensive lead inspection under the Connecticut Department of Public Health Regulations, Section 19a-111-1 to 11. The survey was an XRF lead screening utilizing an XRF and does not satisfy the testing requirements of US EPA's Renovation, Repair and Painting Rule (RRP) under 40 CFR 745.80 through 92. Reliance on this report for determining RRP or CT DPH applicability is not authorized by Langan.

4.0 PCB SEALANT SOURCE MATERIALS

In recent years, the Unites States Environmental Protection Agency (US EPA) has learned that building sealants (e.g. caulking, glazing, expansion joint and other sealant materials) containing potentially harmful PCBs were used in many buildings in the 1950s through the 1980s. PCBs were added to building sealants for durability, resistance to degradation, and as a softener/plasticizer for application. The one sealant compound (interior door window glazing compound) that will be impacted by renovation activities was found to be "newer" and is not assumed to contain PCBs.

5.0 UNIVERSAL WASTE ASSESSMENT

Completion of detailed Universal Waste Assessment (identifying the number and location of Universal Waste items) was not conducted as part of this survey. Universal wastes noted during the visual survey include suspect PCB/DEHP (di (2-ethylhexyl) phthalate) ballasts/capacitors associated with light fixtures, air conditioner and refrigerant coolants, rooftop HVAC units, window air conditioning units, mercury-containing florescent and other mixed used high intensity light bulbs, smoke detectors and other alarms/sensors containing suspect radioactive materials,

batteries and emergency lighting, exit and other signage, possible mercury-containing thermostats, switches, gauges, electronics, paints, wiring, fire extinguishers, cleaning and other chemicals.

All universal waste that is present in the main entryway of the building that will be impacted by renovation activities (if any), will need to be properly removed, recycled, and/or disposed of at a landfill permitted to accept such waste. The removal, handling, recycling, and disposal must be performed in accordance with applicable Federal, State, and local regulations.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Langan provides the following conclusions and recommendations, based on the findings of this limited NESHAP Pre-Renovation Hazardous Building Materials Survey:

Friable ACM was identified above the suspended ceiling tiles in the main entryway. Prior to selective demolition/renovation activities, if the identified ACM will be disturbed/impacted by renovation activities, it must be properly removed and disposed in accordance with applicable Federal, State and Local regulations by a State of Connecticut DPH licensed asbestos abatement contractor. A State of Connecticut licensed Asbestos Designer should create abatement specifications and an Asbestos Project Monitor should perform project oversight and air testing in accordance with the Federal and State regulations. These are all requirements of the CT DPH Standards.

Contractors completing demolition and/or abatement activities should be aware that OSHA has not established a level of lead in a material below which 29 CFR 1926.62 does not apply. All contractors working on the project are responsible for having adequate training (RRP or greater amount) and performing their own OSHA compliance requirements. Contractor shall comply with exposure assessment criteria, interim worker protection and other requirements of the regulation as necessary to protect workers and occupants/residents. All contractors must comply with all applicable State and Federal regulations, including but not limited to the lead OSHA regulations. Metal materials painted in lead-based paint may be recycled. Langan recommends completion of a lead-based paint awareness specification for the project.

The one sealant compound (interior door window glazing compound) that will be impacted by renovation activities was found to be "newer" and is not assumed to contain PCBs.

All universal waste that is present in the main entryway of the building that will be impacted by renovation activities (if any), will need to be properly removed, recycled, and/or disposed of at a landfill permitted to accept such waste. The removal, handling, recycling, and disposal must be performed in accordance with applicable Federal, State, and local regulations. Langan recommends completion of a universal waste recycling/disposal specification for the project if any universal waste requires removal.

7.0 LIMITATIONS

The conclusions and recommendations presented in this report are professional opinions based solely upon Langan's visual observations, laboratory test data, and current regulatory requirements. These conclusions and recommendations are intended exclusively for the purpose stated herein, at the site indicated, and for the project indicated.

It is important to recognize that even the most comprehensive scope of services may fail to detect all hazardous building materials that may be associated with the property. Therefore, Langan cannot act as insurers and cannot "certify" that all hazardous building materials associated with the property have been identified, and no expressed or implied representation or warranty is included or intended in our report, except that our services were performed, within the limits prescribed by our client, with the customary thoroughness and competence of our profession.

Any suspect material that is not listed in this report must be assumed as ACM, PCBs, LBP, etc. until confirmed otherwise via laboratory testing.

Appendix A

Asbestos Analytical Laboratory Results and Chain-of-Custody

LANGAN

EMSL Analytical, Inc.

165 Gracey Avenue Meriden, CT 06451

Tel/Fax: (203) 284-5948 / (203) 284-5978

http://www.EMSL.com / meridenlab@emsl.com

EMSL Order:	242505804
Customer ID:	LANG78
Customer PO:	140327001
Project ID:	

Attention:	Matthew Myers	**Phone:**	(203) 562-5771
	Langan Engineering	**Fax:**	(203) 789-6142
	Long Wharf Maritime Center	**Received Date:**	11/04/2025 2:05 PM
	555 Long Wharf Drive	**Analysis Date:**	11/05/2025
	New Haven, CT 06511	**Collected Date:**	11/04/2025
Project:	140327001		

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
110401A *242505804-0001*	MAIN ENTRANCE-INNER LOBBY DOORS - INTERIOR DOOR WINDOW GLAZING	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
110401B *242505804-0002*	MAIN ENTRANCE-INNER LOBBY DOORS - INTERIOR DOOR WINDOW GLAZING	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
110402A *242505804-0003*	MAIN ENTRANCE-INNER LOBBY DOORS - TERRAZO FLOOR	White/Black Non-Fibrous Homogeneous		5% Quartz 95% Non-fibrous (Other)	None Detected
110402B *242505804-0004*	MAIN ENTRANCE-INNER LOBBY DOORS - TERRAZO FLOOR	White/Black Non-Fibrous Homogeneous		5% Quartz 95% Non-fibrous (Other)	None Detected
110403A *242505804-0005*	MAIN ENTRANCE-INNER LOBBY DOORS - 2X2 CEILING TILES	Gray/Tan/White Fibrous Homogeneous	40% Cellulose 25% Min. Wool	35% Non-fibrous (Other)	None Detected
110403B *242505804-0006*	MAIN ENTRANCE-INNER LOBBY DOORS - 2X2 CEILING TILES	Tan/White Fibrous Homogeneous	60% Cellulose 25% Min. Wool	15% Non-fibrous (Other)	None Detected
110404A *242505804-0007*	MAIN ENTRANCE-INNER LOBBY DOORS - WOOD WALL PANEL ADHESIVE (BLACK)	Black Non-Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
110404B *242505804-0008*	MAIN ENTRANCE-INNER LOBBY DOORS - WOOD WALL PANEL ADHESIVE (BLACK)	Black Non-Fibrous Homogeneous	3% Cellulose	97% Non-fibrous (Other)	None Detected
110405A *242505804-0009*	MAIN ENTRANCE-INNER LOBBY DOORS - COVE BASE	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
110405B *242505804-0010*	MAIN ENTRANCE-INNER LOBBY DOORS - COVE BASE	Black Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
110406A *242505804-0011*	MAIN ENTRANCE - COVE BASE ADHESIVE	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
110406B *242505804-0012*	MAIN ENTRANCE - COVE BASE ADHESIVE	Tan Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 11/05/2025 13:29:32

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Tel/Fax: (203) 284-5948 / (203) 284-5978
http://www.EMSL.com / meridenlab@emsl.com

EMSL Order: 242505804
Customer ID: LANG78
Customer PO: 140327001
Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
110407A *242505804-0013*	MAIN ENTRANCE - BLOCK WALL	Gray/Yellow Non-Fibrous Homogeneous		8% Quartz 92% Non-fibrous (Other)	None Detected
110407B *242505804-0014*	MAIN ENTRANCE - BLOCK WALL	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
110408A *242505804-0015*	MAIN ENTRANCE - BLOCK WALL MORTAR	Gray Non-Fibrous Homogeneous		6% Quartz 94% Non-fibrous (Other)	None Detected
110408B *242505804-0016*	MAIN ENTRANCE - BLOCK WALL MORTAR	Gray Non-Fibrous Homogeneous		6% Quartz 94% Non-fibrous (Other)	None Detected
110408C *242505804-0017*	MAIN ENTRANCE - BLOCK WALL MORTAR	Gray/Yellow Non-Fibrous Homogeneous		6% Quartz 94% Non-fibrous (Other)	None Detected
110409A *242505804-0018*	MAIN ENTRANCE - PIPE INSULATION	White Fibrous Homogeneous	15% Glass	79% Non-fibrous (Other)	**3% Amosite** **3% Crocidolite**
110409B *242505804-0019*	MAIN ENTRANCE - PIPE INSULATION				**Positive Stop (Not Analyzed)**
110409C *242505804-0020*	MAIN ENTRANCE - PIPE INSULATION				**Positive Stop (Not Analyzed)**
110410A *242505804-0021*	MAIN ENTRANCE - PIPE FITTING INSULATION	White Fibrous Homogeneous	5% Cellulose	35% Non-fibrous (Other)	**60% Chrysotile**
110410B *242505804-0022*	MAIN ENTRANCE - PIPE FITTING INSULATION				**Positive Stop (Not Analyzed)**
110410C *242505804-0023*	MAIN ENTRANCE - PIPE FITTING INSULATION				**Positive Stop (Not Analyzed)**
110411A *242505804-0024*	MAIN ENTRANCE - FIRE DOOR INSULATION (NEWER?)	Gray/White Non-Fibrous Homogeneous	10% Cellulose	5% Quartz 85% Non-fibrous (Other)	None Detected
110411B *242505804-0025*	MAIN ENTRANCE - FIRE DOOR INSULATION (NEWER?)	Gray/Tan/White Non-Fibrous Homogeneous	10% Cellulose 5% Glass	5% Perlite 80% Non-fibrous (Other)	None Detected

Analyst(s)
Cory Walker (9)
Thomas Lanzarone (12)

Danny Sandhu, Asbestos Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 “Interim Method”) but augmented with procedures outlined in the 1993 (”final”) version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Meriden, CT NVLAP Lab Code 200700-0,

Initial report from: 11/05/2025 13:29:32

OrderID: 242505804

Asbestos Bulk Building Material Chain of Custody

EMSL Order Number (Lab Use Only): 242505804

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Company: Langan CT	EMSL-Bill to: ☐ Same ☒ Different If Bill to is Different note instructions in Comments**
Street: 555 Long Wharf Drive	*Third Party Billing requires written authorization from third party*
City: New Haven State/Province: CT	Zip/Postal Code: 06511 Country: USA
Report To (Name): Matthew Myers	Telephone #: 203.562.5771
Email Address: mmyers@langan.com	Fax #: 203.789.6142 Purchase Order:
Project Name/Number: 190327001	Please Provide Results: ☐ Fax ☒ Email Public School
U.S. State Samples Taken: CT	CT Samples: ☐ Commercial/Taxable ☒ Residential/Tax Exempt

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☒ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week

*For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PLM - Bulk (reporting limit)	TEM – Bulk
☒ PLM EPA 600/R-93/116 (<1%)	☐ TEM EPA NOB – EPA 600/R-93/116 Section 2.5.5.1
☐ PLM EPA NOB (<1%)	☐ NY ELAP Method 198.4 (TEM)
Point Count ☒ 400 (<0.25%) ☐ 1000 (<0.1%) **If <3%**	☐ Chatfield Protocol (semi-quantitative)
Point Count w/Gravimetric ☐ 400 (<0.25%) ☐ 1000 (<0.1%)	☐ TEM % by Mass – EPA 600/R-93/116 Section 2.5.5.2
☐ NIOSH 9002 (<1%)	☐ TEM Qualitative via Filtration Prep Technique
☐ NY ELAP Method 198.1 (friable in NY)	☐ TEM Qualitative via Drop Mount Prep Technique
☐ NY ELAP Method 198.6 NOB (non-friable-NY)	**Other**
☐ OSHA ID-191 Modified	☐
☐ Standard Addition Method	

☒ Check For Positive Stop – Clearly Identify Homogenous Group Date Sampled: 11/4/25

Samplers Name: Hilton Hernandez Samplers Signature:

Sample #	HA #	Sample Location	Material Description
110401A		Main Entrance – Inner Lobby Doors	Interior Door Window Glazing
B		"	"
02A		"	Terrazo Floor
B		"	"
03A		"	2x2 Ceiling Tiles
B		"	"
04A		"	Wood wall panel Adhesive (Black)
B		"	"
05A		"	cove base
B		"	"

RECEIVED NOV 04 2025 By IA DS

Client Sample # (s): Total # of Samples: 25

Relinquished (Client): Date: Time:

Received (Lab): Date: Time:

Comments/Special Instructions:

Bill To: Langan_InvoiceCapture@ Concur Solutions.com

OrderID: 242505804

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Asbestos Bulk Building Material Chain of Custody

EMSL Order Number (*Lab Use Only*): 242505804

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	HA #	Sample Location	Material Description
110406A		Main Entrance	Cove base adhesive
B		"	"
07A			Block Wall
B			"
08A			Mortar
B			"
C			"
09A			Pipe Insulation
B			"
C			"
10A			Pipe Fitting Insulation
B			"
C			"
11A		"	Fire Door Insulation (newer?)
B		"	"

RECEIVED
NOV 04 2025
By 14:05

***Comments/Special Instructions:**

Page 2 of 2 pages

Appendix B

XRF Field Data Sheets

PRELIMINARY XRF
LBP TESTING DATA SHEET

Client Name: SP&A / Greenwich

Site Address 51 Hendrie Ave Eastern Middle School

Project No. 140327031

Survey Date 11/4/25

Total Assays Reported:

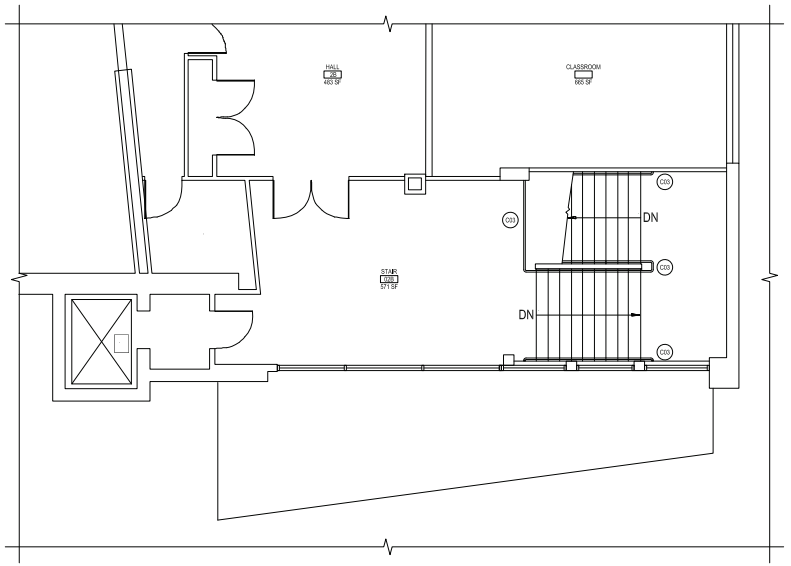
Survey ID#	Component	Substrate	Paint Color	Test Location	XRF Readings K Shell mg/cm2	XRF Readings L Shell mg/cm2	XRF Readings K-Fe mg/cm2	Results	Comments
1	calibrate								
2	"							1.0	
3	"							1.0	
4	~~Door~~ Wall Panel	wood	white	Main Entrance ~~Front~~				1.0	
5	Door Trim	metal	black	Door wall right				0	
6	wood wall	wood	white	"				-0.1	
7	Door Trim	metal	Black	Principals office				0	
8	Handrail	"	"	"				0.4	
9	stair Baseboard	I	"	stairs				3.1	
10	calibrate			"				2.1	
11	"							0.9	
12	"							0.9	
								1.0	

Notes: N = Negative
P = Positive

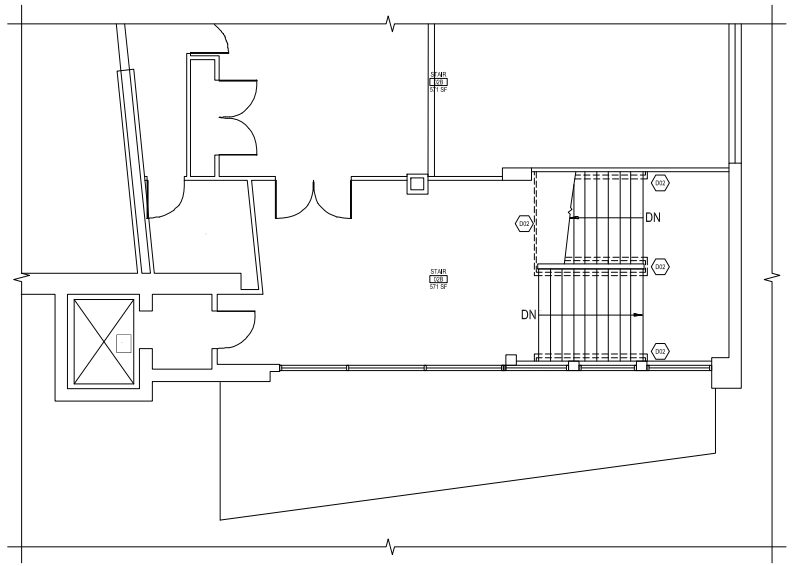
Appendix C

Building Drawing

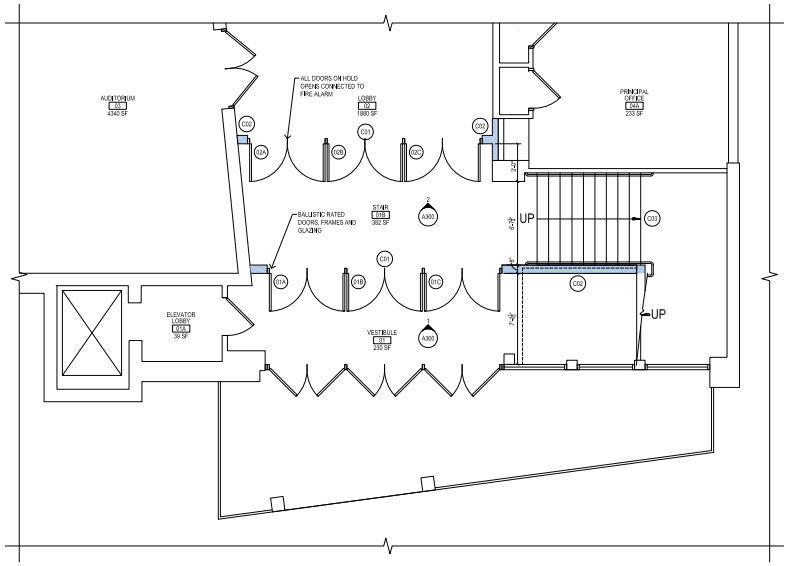
LANGAN



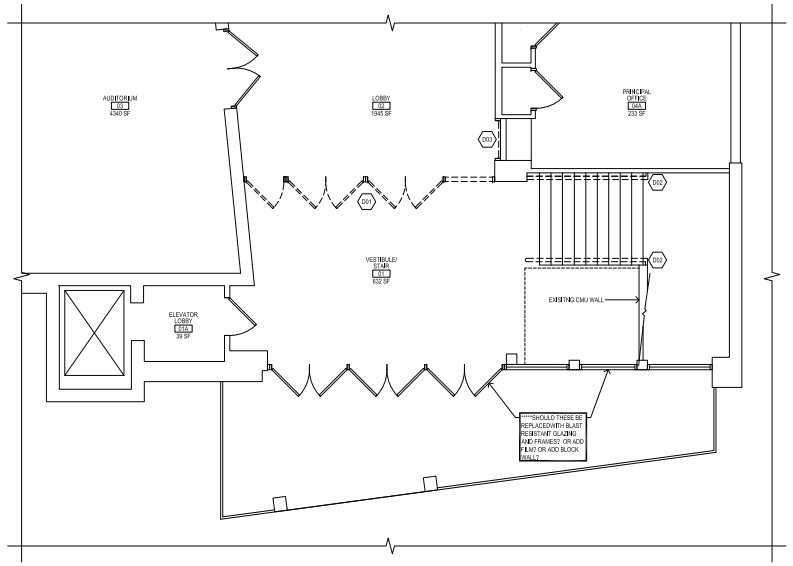
4 SECOND FLOOR PLAN
1/4"=1'-0"



3 DEMOLITION SECOND FLOOR PLAN
1/4"=1'-0"



2 FIRST FLOOR PLAN
1/4"=1'-0"



1 DEMOLITION FIRST FLOOR PLAN
1/4"=1'-0"

SYMBOL LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTING DOOR TO REMAIN
- EXISTING DOOR TO BE REMOVED
- KEY NOTE - DEMOLITION
- AREA/ALC.

GENERAL DEMOLITION NOTES

A. NOT ALL DEMOLITION KEYNOTES WILL BE PRESENT ON EVERY SHEET.

B. REMOVE EXISTING INTERIOR STUD WALLS AS INDICATED ON DRAWINGS, INCLUDING ALL BASE, TRIM AND WALL MOUNTED DEVICES. REFER TO M/E/P DRAWINGS FOR ADDITIONAL DEMOLITION COORDINATION.

C. REMOVE EXISTING DOORS, FRAMES, SIDELITES AND HARDWARE AS INDICATED ON DRAWINGS.

D. SALVAGE ALL EXISTING WALL MOUNTED AND SEMI-RECESSED FIRE EXTINGUISHER CABINETS ON WALLS TO BE DEMOLISHED AND RETURN TO OWNER.

E. EXISTING WINDOW TREATMENTS TO REMAIN. PROTECT DURING CONSTRUCTION FROM DAMAGE AND DUST.

F. REMOVE ALL FINISHED FLOOR MATERIALS IN SCOPE OF WORK AREA INCLUDING BUT NOT LIMITED TO CARPET, VCT AND LVT. REMOVE ALL ASSOCIATED WALL BASE.

G. REMOVE ALL EXISTING CEILING MOUNTED LIGHT FIXTURES. REFER TO ELECTRICAL DRAWINGS FOR ADDITIONAL DEMOLITION INFORMATION.

H. REMOVE ALL EXISTING INTERIOR ROOM SIGNAGE EXCEPT AT STAIRWELL DOORS.

I. COORDINATE SELECTIVE DEMOLITION OF WALLS AND/OR COLUMN ENCLOSURES AS REQ'D TO ACCOMMODATE NEW ELECTRICAL AND DATA TO ALLOW NEW WORK TO BE RECESSED AND NOT SURFACE MOUNTED.

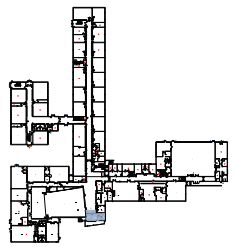
J. CONTRACTOR TO COORDINATE SELECTIVE DEMOLITION OF EXISTING WALLS AS REQ'D TO INSTALL FIRE TREATED WOOD BLOCKING AT ALL WALL MOUNTED CABINETRY, MONITORS, WHITEBOARDS, ETC.

DEMOLITION KEYNOTES

1. REMOVE DOOR, FRAME, GLAZING, BLOCKING, TRANSOMS, THRESHOLD & ASSOCIATED COMPONENTS.
2. REMOVE EXISTING HANDRAILS AND GUARDRAILS.
3. REMOVE EXISTING WOOD DOOR, HOLLOW METAL FRAME AND HARDWARE.

CONSTRUCTION NOTES

1. DOOR/FRAME SYSTEM:
   - DOOR, FRAME, GLAZING, HARDWARE AND ASSOCIATED COMPONENTS (PER MANUFACTURER), SEE DOOR/FRAME TYPES, SCHEDULE, DETAILS AND PROJECT MANUAL FOR ADDITIONAL INFORMATION.
2. FINISH WALLS (SEE PARTITION TYPES ON A800):
   - PATCH & REPAIR ALL EXISTING WALLS (MATCH EXISTING) AS REQUIRED WHERE DEMO & NEW AFFECT EXISTING.
3. NEW HANDRAILS AND GUARD RAILS:
   - SEE DETAILS ON...
   -



Project Title:
SCHEMATIC DESIGN:
GREENWICH PUBLIC SCHOOLS - SECURE ENTRANCES
EASTERN MIDDLE SCHOOL
51 HENDRIE AVE
RIVERSIDE, CT 06878

SILVER PETRUCELLI + ASSOCIATES
3190 WHITNEY AVENUE HAMDEN CT 06518
311 STATE STREET NEW LONDON CT 06320
203 230 9007 silverpetrucelli.com

Revisions:	Description:	Date:	Revised By:
	-	-	

Drawing Title:
DEMOLITION PLAN AND FLOOR PLAN

Date: 8/5/2025
Scale: 1/4"= 1'-0"
Drawn By: MHM
Project Number: 24-179
Drawing Number: A100

Appendix D

Langan Certifications and Accreditations

LANGAN

Dear HILTON HERNANDEZ,

Attached you will find your validated certificate for the coming year. Should you have any questions about your certificate renewal, please do not hesitate to write or call:

Department of Public Health
P.O. Box 340308
M.S.#12MQA
Hartford, CT 06134-0308

(860) 509-7603
oplc.dph@ct.gov
www.ct.gov/dph/license

Sincerely,

MANISHA JUTHANI, MD, COMMISSIONER
DEPARTMENT OF PUBLIC HEALTH

1000237-0000241-0000001 of 0000001-C01-a1d00101-0764-00239

EMPLOYER'S COPY

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
HILTON HERNANDEZ

VALIDATION NO.	CERTIFICATE NO	CURRENT THROUGH
03-178495	000424	01/31/26

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE — MANISHA JUTHANI, MD, COMMISSIONER

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT

THE INDIVIDUAL NAMED BELOW IS CERTIFIED
BY THIS DEPARTMENT AS A
ASBESTOS CONSULTANT-INSPECTOR

HILTON HERNANDEZ

CERTIFICATE NO.
000424

CURRENT THROUGH
01/31/26

VALIDATION NO
03-178495

SIGNATURE — MANISHA JUTHANI, MD, COMMISSIONER

INSTRUCTIONS:

1. Detach and sign each of the cards on this form
2. Display the large card in a prominent place in your office or place of business.
3. The wallet card is for you to carry on your person. If you do not wish to carry the wallet card, place it in a secure place.
4. The employer's copy is for persons who must demonstrate current licensure/certification in order to retain employment or privileges. The employer's card is to be presented to the employer and kept by them as a part of your personnel file. Only one copy of this card can be supplied to you.

WALLET CARD

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
HILTON HERNANDEZ

VALIDATION NO.	CERTIFICATE NO	CURRENT THROUGH
03-178495	000424	01/31/26

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE — MANISHA JUTHANI, MD, COMMISSIONER

CERTIFICATE OF ACHIEVEMENT

This certifies that

Hilton Hernandez

has successfully completed the

4 Hour Asbestos Site Inspector Refresher Training
Asbestos Accreditation Under TSCA Title II
40 CFR Part 763



conducted by:
ATLAS Technical Consultants, LLC
73 William Franks Drive
West Springfield, MA 01089
(413) 781-0070

Training held via Live Webinar

Exam Score: 92%

Principal Instructor: Thomas Dion

March 20, 2025
Date of Course

March 20, 2026
Expiration Date

Regional Training Director: Judith LaVallee

SIAR - 7995
Certificate Number

March 20, 2025
Examination Date

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT

THE INDIVIDUAL NAMED BELOW IS CERTIFIED
BY THIS DEPARTMENT AS A

ASBESTOS CONSULTANT-INSP/MGMT PLANNER

MATTHEW A. MYERS

CERTIFICATE NO.
000041

CURRENT THROUGH
04/30/26

VALIDATION NO.
03-189921

SIGNATURE

MANISHA JUTHANI-MD, COMMISSIONER

QuES&T

Quality Environmental Solutions & Technologies, Inc.
1376 Route 9, Wappingers Falls, NY 12590
Phone (845) 298-6031 Fax (845) 298-6251

HEREBY CERTIFIES THAT

MATTHEW MYERS

HAS SUCCESSFULLY COMPLETED A TRAINING SEMINAR IN:

NYS/EPA INSPECTOR REFRESHER

MEETING THE REQUIREMENTS OF NYSDOH 10 NYCRR, PART 73 AND TSCA TITLE II AND HAS BEEN AWARDED THIS CERTIFICATE BY:

Michael E. O'Rourke

MICHAEL O'ROURKE
TRAINING DIRECTOR

NOTE: Official record of successful completion is DOH 2832 Certificate of Completion of Asbestos Safety Training

NOTE: DOH 2832 - A $20 fee shall be charged for replacement of Certificate of Completion DOH 2832

ON THIS DATE: 03/05/2025

CERTIFICATE NUMBER:972235 **EXPIRATION DATE: 03/05/2026**

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STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT

THE INDIVIDUAL NAMED BELOW IS CERTIFIED
BY THIS DEPARTMENT AS A

LEAD INSPECTOR RISK ASSESSOR

MATTHEW A. MYERS

CERTIFICATE NO.
000191

CURRENT THROUGH
04/30/26

VALIDATION NO.
03-189922

SIGNATURE

MANISHA JUTHANI, MD, COMMISSIONER

CERT#: L-600-Virtual.1469

CHEMSCOPE TRAINING DIVISION

LEAD INSPECTOR/RISK ASSESSOR REFRESHER
8-HOUR TRAINING CERTIFICATE

Matthew Myers

10 Lewis Street, Milford CT

Has attended an 8-hour course on the subject discipline on
01/15/2025 and has passed a written examination.

The above individual has successfully completed the above training course approved in accordance with the Department of Public Health Standards established pursuant to Section 20-477 of the Connecticut General Statutes. Course topics include all required topics of State of Connecticut DPH and EPA.

Under civil and criminal penalties of law for the making or submission of false or fraudulent statements or representations (U.S.C. 1001 and 15 U.S. C. 2615), I certify that this training complies with all applicable requirements of Title IV of TSCA, 40 CFR part 745 and any other applicable Federal, State or local requirements.

Examination Score: 100%
Exam Date: 01/15/2025
Expiration Date: 01/15/2026

Daniel Sullivan
Training Manager

Chem Scope, Inc.
15 Moulthrop Street
North Haven CT 06473
Phone: 203.865.5605
www.chem-scope.com

PROJECT TITLE:

GREENWICH PUBLIC SCHOOLS - EASTERN MIDDLE SCHOOL

SECURE ENTRANCE

51 HENDRIE AVE
RIVERSIDE, CONNECTICUT 06878

PROJECT LOCATION:



SILVER PETRUCELLI + ASSOCIATES

3190 WHITNEY AVENUE HAMDEN CT 06518
311 STATE STREET NEW LONDON CT 06320
203 230 9007 silverpetrucelli.com

ISSUED FOR BID: 11/10/2026

DRAWING LIST

COVER SHEET

GENERAL:

G001 ABBREVIATIONS & SYMBOL LEGEND
G002 CODE PLANS & INFORMATION

ENVIRONMENTAL:

HBM-01 FIRST FLOOR HAZARDOUS BUILDING MATERIALS ABATEMENT PLAN

ARCHITECTURAL:

A110 DEMOLITION PLAN & FLOOR PLAN
A250 REFLECTED CEILING PLANS & DETAILS
A460 INTERIOR ELEVATIONS
A600 RAILING DETAILS
A850 DOOR SCHEDULE, TYPES & DETAILS

MECHANICAL:

M001 MECHANICAL ABBREVIATIONS, NOTES & SYMBOLS
M100 MECHANICAL PARTIAL FLOOR PLAN
M300 MECHANICAL DETAILS

ELECTRICAL:

E001 GENERAL NOTES, ABBREVIATIONS & LEGEND
E100 PARTIAL FIRST FLOOR PLANS - LIGHTING
E200 PARTIAL FIRST & SECOND FLOOR PLANS - POWER
E600 DETAILS

TECHNOLOGY:

T001 GENERAL NOTES, ABBREVIATIONS & LEGEND
T100 PARTIAL FIRST & SECOND FLOOR PLANS - TECHNOLOGY
T600 DETAILS

ARCHITECT
SILVER PETRUCELLI + ASSOCIATES
3190 WHITNEY AVENUE, HAMDEN CT 06518
311 STATE STREET NEW LONDON, CT 06320
PHONE 203 230 9007 silverpetrucelli.com

M/E/P/FP ENGINEERS
SILVER PETRUCELLI + ASSOCIATES
3190 WHITNEY AVENUE, HAMDEN CT 06518
311 STATE STREET NEW LONDON, CT 06320
PHONE 203 230 9007 silverpetrucelli.com

ENVIRONMENTAL
LANGAN
555 LONG WARF DRIVE, CT 06511
PHONE 203 562 5771 langan.com

FULL SCALE PRINT: 30"x42"

ARCHITECTURAL ABBREVIATIONS

A.B.	ANCHOR BOLT
A.C.P.	ASBESTOS CEMENT PIPE
ADJ.	ADJUSTABLE
A.F.F.	ABOVE FINISH FLOOR
AC.T.	ACOUSTICAL CEILING TILE
ALUM.	ALUMINUM
APPROX.	APPROXIMATE(LY)
ARCH.	ARCHITECTURAL
ASPH.	ASPHALT
AVG.	AVERAGE
BSMT.	BASEMENT
BD.	BOARD
BRG.	BEARING
BRK.	BRICK
BIT.	BITUMINOUS
BLK.	BLOCK
BLDG.	BUILDING
B.S.	BOTH SIDES
C.B.	CATCH BASIN
C.B.R.	CATCH BASIN TO BE REMOVED
C.I.	CAST IRON
C.I.P.	CAST-IN-PLACE CONCRETE
CLG.	CEILING
℄	CENTER LINE
C. BD.	CHALK BOARD
C.O.	CLEAN OUT
COL.	COLUMN
CONC.	CONCRETE
C.M.U.	CONCRETE MASONRY UNIT
CONF.	CONFERENCE
CONSTR.	CONSTRUCTION
CONT.	CONTINUOUS, CONTINUE
C.J.	CONTROL/CONSTRUCTION JOINT
CONTR.	CONTRACTOR
C.C.	CURB CUT
DET.	DETAIL
DIA.	DIAMETER
DIM.	DIMENSION
DR.	DOOR
DN.	DOWN
DWG.	DRAWING
E	ELECTRICAL
EA.	EACH
ECTR.	EXISTING CEILING TO REMAIN
ED.	EDUCATION
ELEC.	ELECTRICAL
E.F.	EACH FACE
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEV.	ELEVATION
EMER.	EMERGENCY
ENCL.	ENCLOSURE
ENL.	ENLARGED
ENT.	ENTRANCE
EP.	EPOXY PAINT
EQ.	EQUAL
ES.	EXPOSED STRUCTURE
E.T.R.	EXISTING TO REMAIN
E.W.	EACH WAY
E.W./E.F.	EACH WAY/EACH FACE
EXAM.	EXAMINATION
EX.	EXISTING
EXP.	EXPANSION
EXT.	EXTERIOR
FDN.	FOUNDATION
F.F.	FINISHED FLOOR
F.P.	FOLDING PARTITION
FIN.	FINISH, FINISHED
FIXT.	FIXTURE
FL.	FLOOR
FT.	FOOT
F.S.	FAR SIDE
FTG.	FOOTING
G	GAS
GA.	GAGE, GAUGE
GEN.	GENERAL
G.C.	GENERAL CONTRACTOR
GYP.	GYPSUM
GYP. BD.	GYPSUM BOARD
GWB.	GYPSUM (WALL) BOARD
H.C.	HANDICAPPED
HD.	HEADED
HDWR.	HARDWARE
HGT.	HEIGHT
H.P.	HIGH POINT
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL, HORIZONTALLY
H.B.	HOSE BIBB
HR.	HOUR
HYD.	HYDRANT
INSUL.	INSULATION, INSULATED
INT.	INTERIOR
INV.	INVERT
JAN.	JANITOR
K.P.	KICK PLATE
LAM.	LAMINATE
L.F.	LINEAL FOOT
LG.	LONG
LOC.	LOCATION
L.P.	LOW POINT
LTG.	LIGHTING
LVL.	LEVEL
M.	MINUTE
MAS.	MASONRY
MAX.	MAXIMUM
MECH.	MECHANICAL
M.H.	MANHOLE
MIN.	MINIMUM
MISC.	MISCELLANEOUS
M.O.	MASONRY OPENING
MTD.	MOUNTED
MTL.	METAL
N.A.	NOT APPLICABLE
N.I.C.	NOT IN CONTRACT
NO.	NUMBER
NOM.	NOMINAL
N.P.S.	NOMINAL PIPE SIZE
N.S.	NEAR SIDE
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
O.C.C.	OCCUPANT
O.D.	OUTSIDE DIAMETER
OPNG.	OPENING
P.C.B.	PAINTED CONCRETE BLOCK
P.G.B.	PAINTED GYPSUM BOARD
PL.	PLATE
PLUMB.	PLUMBING
PLYWD.	PLYWOOD
PREP.	PREPARATION
P.T.	PRESSURE TREATED
PTD.	PAINTED
P.V.C.	POLYVINYL CHLORIDE
R.	RISER
RAD.	RADIUS
R.C.P.	REINFORCED CONCRETE PIPE
R.D.	ROOF DRAIN
REINF.	REINFORCEMENT
REQ'D.	REQUIRED
R.H.	ROOF HATCH
R.L.	ROOF LEADER
RM.	ROOM
S.	STORM
SAN.	SANITARY
S.C.	SEALED CONCRETE
SCHED.	SCHEDULE
SECT.	SECTION
S.F.	STEP FOOTING
SIM.	SIMILAR
S.O.G.	SLAB ON GRADE
SPEC.	SPECIFICATIONS
SQ.	SQUARE
SQ. FT.	SQUARE FEET
STL.	STEEL
STRUCT.	STRUCTURAL
SUSP.	SUSPENDED, SUSPENSION
S.W.	SHEAR WALL
S.W.F.	SHEAR WALL FOOTING
SYS., SYST.	SYSTEM
T.	TELEPHONE
T&B	TOP & BOTTOM
TECH.	TECHNOLOGY
T.O.	TOP OF
T.O.F.	TOP OF FRAME
T.O.S.	TOP OF STEEL
T/S	TOP OF SLAB
T/W	TOP OF WALL
T.T.F.	TRIM TO FIT
TYP.	TYPICAL
U.O.N.	UNLESS OTHERWISE NOTED
V.B.	VINYL BASE
V.C.T.	VINYL COMPOSITE TILE
VERT.	VERTICAL
V.I.F.	VERIFY IN FIELD
W.	WATER
W	WITH
W.C.J.	WALL CONTROL JOINT
WD.	WOOD
WF.	WIDE FLANGE
WNDW.	WINDOW
W.W.F.	WELDED WIRE FABRIC
W.W.M.	WELDED WIRE MESH
@	AT
℄	DIAMETER

GRAPHIC SYMBOLS

ROOM NAME / ROOM NUMBER — XXX — ROOM IDENTIFICATION

ROOM NAME / ROOM NUMBER / MATERIAL - HEIGHT — ### / ACT-1 | #'-#" — CEILING PLAN ROOM IDENTIFICATION

ROOM NAME / MATERIAL - RM. NUMBER / SQ. FT. — CPT-1 | ## / SQ. FT. — FINISH FLOOR PLAN ROOM IDENTIFICATION

CABINET TYPE / NOMINAL HEIGHT/WIDTH / SPECIAL DEPTH &/OR EQUIP. — CB1 / 3630 / 18" — CASEWORK SYMBOL

XXX — EQUIPMENT SYMBOL

XXX — DOOR NUMBER

XX — DEMOLITION NOTE

XX — WINDOW TYPE

XX / XX — DETAIL NUMBER / DRAWING NUMBER

XX — CONSTRUCTION NOTE

X / X — SECTION/DETAIL DRAWING NUMBER

XX / XX — XX / XX — BUILDING SECTION DRAWING NUMBER

XX / XX — WALL SECTION DRAWING NUMBER

XX / XX — EXTERIOR ELEVATION DRAWING NUMBER

/ # XXX # / # — "#" INTERIOR ELEVATION; "XX" DRAWING NUMBER

X — WALL TYPE

X — REVISION MARK

X / X — COLUMNS (EXISTING)

detail # / SHEET # — XX / XX — DETAIL CALL OUT

ELEVATION / LABEL — ELEVATION MARKER

DATUM POINT

— REVISION CLOUD

DRAFTING CONVENTIONS

EXISTING DOOR

EX. DOOR TO BE REMOVED

NEW DOOR

DOUBLE LEAF DOOR

DOOR W/ 180 HOLD OPEN

VARYING LEAF DOOR

TWO-WAY DOOR

POCKET DOOR

BI- FOLDING DOOR

SLIDING DOOR

DOUBLE ACTING DOOR

MATERIAL CONVENTIONS

BRICK (PLAN / SECTION)

CONCRETE MASONRY UNIT (CMU) (PLAN / SECTION)

CONCRETE (CAST-IN-PLACE)

CONCRETE (PRE-CAST)

RIGID BOARD INSULATION

INSULATION (BATT)

EARTH

GYPSUM BOARD

PLYWOOD

WOOD FRAMING (THRU MEMBER)

WD FRAMING (UNINTERRUPTED MEMBER)

WD TRIM/FINISH

ACOUSTICAL TILE OR PANEL

WALL OPENING INDICATIONS

TYPICAL WALL

WALL TO BE REMOVED

TYPICAL WINDOW

EXISTING CONSTRUCTION

WINDOW WALL

RECESSED ITEM

RCP DRAWING SYMBOLS

2X2 LIGHT FIXTURE

LINEAR FIXTURE

RECESSED LIGHT FIXTURE

SUPPLY DIFFUSER

RETURN DIFFUSER

EXHAUST DIFFUSER

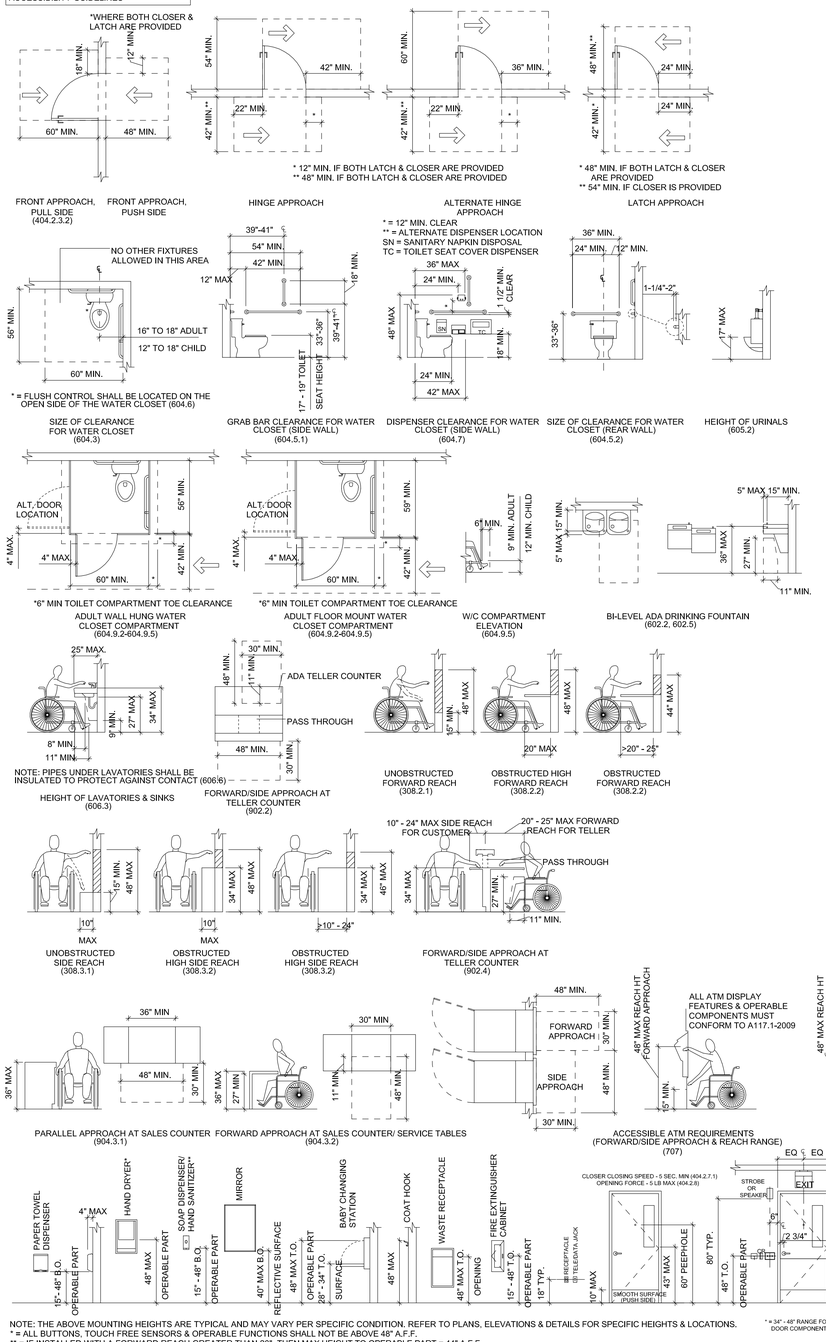
SPRINKLER HEAD

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO FEDERAL, STATE AND MUNICIPAL CODES AND ORDINANCES. THESE SHALL SUPERSEDE DRAWINGS, NOTES AND DIMENSIONS IN ALL CASES. THE ARCHITECT SHALL BE NOTIFIED OF SUCH CHANGES BEFORE WORK IS STARTED. CONTRACTOR SHALL OBTAIN PERMITS BEFORE STARTING WORK, AND OBTAIN APPROVALS OF ALL REGULATORY AGENCIES UPON COMPLETION, AND AS REQUIRED THE CONTRACT DOCUMENTS CONSIST OF THE DRAWINGS, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, OWNER-CONTRACTOR AGREEMENTS AND ALL ADDENDA ISSUED PRIOR TO AND ALL PLAN CHANGES ISSUED AFTER EXECUTION OF THE CONTRACT.
2. UNLESS OTHERWISE INDICATED IN THE CONSTRUCTION DOCUMENTS AS BEING NOT IN CONTRACT (N.I.C.) OR EXISTING; ALL ITEMS, MATERIALS AND INSTALLATION OF SAME ARE A PART OF THE CONTRACT DEFINED BY THE CONSTRUCTION DOCUMENTS.
3. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL ACCESSORIES, COMPONENTS AND ASSEMBLIES REQUIRED FOR THE WORK SHOWN. GENERAL CONTRACTOR SHALL SUBMIT A DETAILED PROJECT SCHEDULE AND IS SOLELY RESPONSIBLE FOR CONSTRUCTION SEQUENCING, METHODS AND TECHNIQUES.
4. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR PAYING FOR AND OBTAINING ALL PERMITS, INSPECTIONS, REQUIRED TESTS AND UTILITY CONNECTIONS, TERMINATIONS, AND CAPPING UNLESS OTHERWISE NOTED.
5. GENERAL CONTRACTOR SHALL PROVIDE AND IS SOLELY RESPONSIBLE FOR PUBLIC & EMPLOYEE PROTECTION AS NECESSARY AND AS REQUIRED BY THE CODES, ORDINANCES AND REGULATIONS OF GOVERNMENTAL AGENCIES HAVING JURISDICTION AT THE PROJECT PLACE.
6. ANY WORK INVOLVING ALTERATION TO EXISTING BUILDING UTILITIES & WHICH REQUIRE UTILITY SHUT DOWN, SHALL BE COORDINATED WITH THE OWNER AND SHALL REQUIRE A MIN OF (5) DAYS NOTICE (OR PER ALL REQUIREMENTS).
7. IN THE EVENT OF DISCREPANCIES IN THE DRAWINGS, THE COSTLIER OR MORE RESTRICTIVE CONDITIONS SHALL BE DEEMED THE CONTRACT REQUIREMENT, UNLESS OTHERWISE STATED IN WRITING, FROM THE OWNER OR OWNER'S REPRESENTATIVE. ANY DISCREPANCIES SHOULD IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ARCHITECT.
8. GENERAL CONTRACTOR SHALL WARRANT WORK PERFORMED FOR A PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE.
9. VERIFY DIMENSIONS AND JOB CONDITIONS PRIOR TO SUBMITTING BIDS AND REPORT THE ARCHITECT AND/OR OWNER DISCREPANCIES WHICH WOULD INTERFERE WITH SATISFACTORY COMPLETE OF THE WORK (DO NOT RELY ON SCALED DRAWINGS).
10. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO KEEP THE PREMISES CLEAN OF DEBRIS, RUBBISH, EXCESS MATERIALS, ETC. RESULTING FROM THE WORK OF THIS CONTRACT. OFFICE AREAS SHALL BE BROOM CLEAN EACH WORK DAY.
11. CHARGES FOR EXTRA WORK DONE BY THE CONTRACTOR WILL NOT BE HONORED UNLESS THE WORK AND THE AMOUNT ARE AGREED TO BY THE OWNER, OR THEIR AGENT, IN WRITING BEFORE THE WORK IS DONE, BASED UPON UNIT PRICING.
12. AS REQUIRED BY CODE, EACH CONTRACTOR AND EACH SUBCONTRACTOR SHALL OBTAIN REQUIRED INSPECTION OF THAT PORTION OF WORK.
13. ALL AREAS OF DEMOLITION MUST BE PATCHED, REPAIRED AND INFILLED TO MATCH EXISTING / ADJACENT CONDITIONS.
14. REFER TO ME/P DRAWINGS FOR ADDITIONAL DEMOLITION AND NEW WORK COORDINATION. COORDINATE ALL TRADES.

ICC/ANSI A117.1-2009
ADA AND/OR BARRIER FREE HANDICAPPED ACCESSIBILITY GUIDELINES

GENERAL NOTE:
ALL DIMENSIONS SHOWN ARE FINISH FACE DIMENSIONS.



NOTE: THE ABOVE MOUNTING HEIGHTS ARE TYPICAL AND MAY VARY PER SPECIFIC CONDITION. REFER TO PLANS, ELEVATIONS & DETAILS FOR SPECIFIC HEIGHTS & LOCATIONS.
* = ALL BUTTONS, TOUCH FREE SENSORS & OPERABLE FUNCTIONS SHALL NOT BE ABOVE 48" A.F.F.
** = IF INSTALLED WITH A FORWARD REACH GREATER THAN 20", THEN MAX HEIGHT TO OPERABLE PART = 44" A.F.F.
TYP. EQUIPMENT/ACCESSORY MOUNTING HEIGHTS

1 TYPICAL ADA MOUNTING HEIGHTS & REQUIREMENTS
SCALE: NONE

Project Title:
GREENWICH PUBLIC SCHOOLS - EASTERN MIDDLE SCHOOL
SECURE ENTRANCE

51 HENDRIE AVE
RIVERSIDE, CT 06878

SILVER PETRUCELLI + ASSOCIATES
3190 WHITNEY AVENUE HAMDEN CT 06518
311 STATE STREET NEW LONDON CT 06320
203 230 9007 silverpetrucelli.com

Revision:	Description:	Date:	Revised By:
	-	-	

Drawing Title: ABBREVIATIONS & SYMBOL LEGEND
Project Phase: ISSUED FOR BID
State Project Number: N/A

Date: 11/10/2026
Scale: AS NOTED
Drawn By: MHM
Project Number: 24-179

Drawing Number: G001

TYPE 1

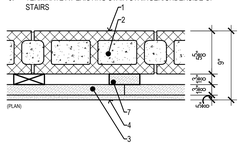
1. 6" CONCRETE MASONRY UNIT, PAINTED
2. REINFORCED CONCRETE FILLED CELLS
3. BULLET RESISTANT FIBERGLASS PANEL, LEVEL 4
4. ½" ABUSE RESISTANT GYPSUM WALLBOARD, PAINTED
5. HORIZONTAL REINFORCING
6. RESILIENT BASE
7. BULLET RESISTANT FIBERGLASS CONTINUOUS BATTEN STRIP @ JOINT, PER MANUFACTURER

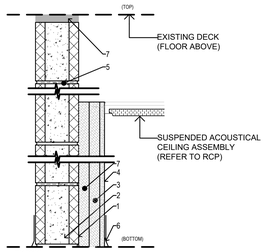
SECTION 1A:

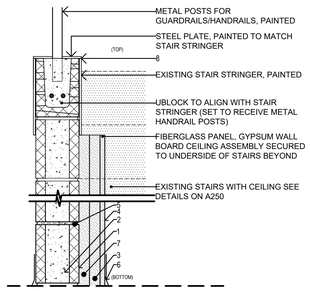
8. TERMINATE CMU TO STRUCTURE ABOVE/ TERMINATE FIBERGLASS & GYPSUM ABOVE CEILING

SECTION 1B:

9. TERMINATE AT EXISTING STAIR STRINGER/UNDERSIDE OF STAIRS





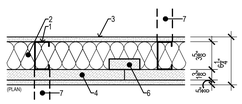


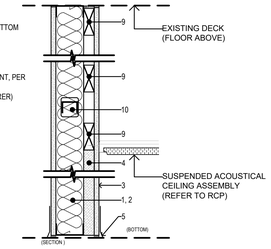
TYPE 2

1. 3-⅝" METAL STUD @ 16" O.C. WITH DEFLECTION TRACKS TOP AND BOTTOM
2. SOUND ATTEN. INSULATION
3. ½" ABUSE RESISTANT GYPSUM WALLBOARD, PAINTED
4. BULLET RESISTANT FIBERGLASS PANEL, LEVEL 4
5. RESILIENT BASE
6. BULLET RESISTANT FIBERGLASS CONTINUOUS BATTEN STRIP @ JOINT, PER MANUFACTURER
7. 45° KICKERS ABOVE CEILING, (BOTH DIRECTIONS PER MANUFACTURER)

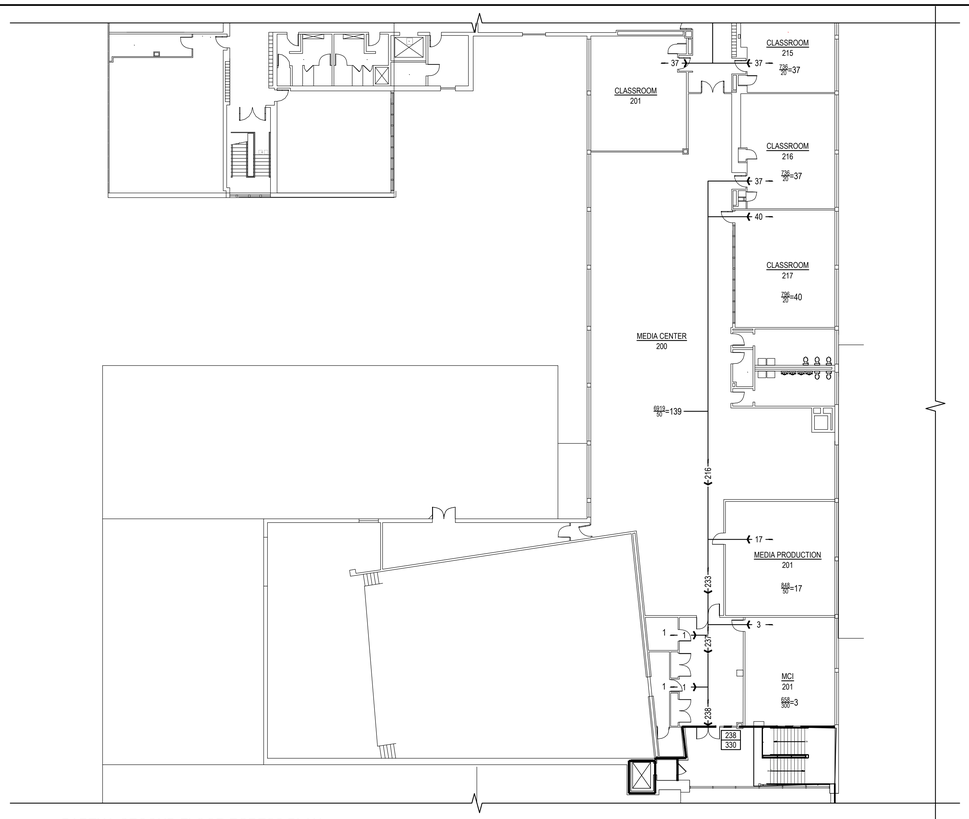
SECTION:

8. TERMINATE CMU AND GYPSUM TO STRUCTURE ABOVE/ TERMINATE FIBERGLASS ABOVE CEILING
9. WOOD BLOCKING AT PANEL AND AT ‡ POINTS TO TOP OF DECK
10. BRACING AT 3RD POINTS

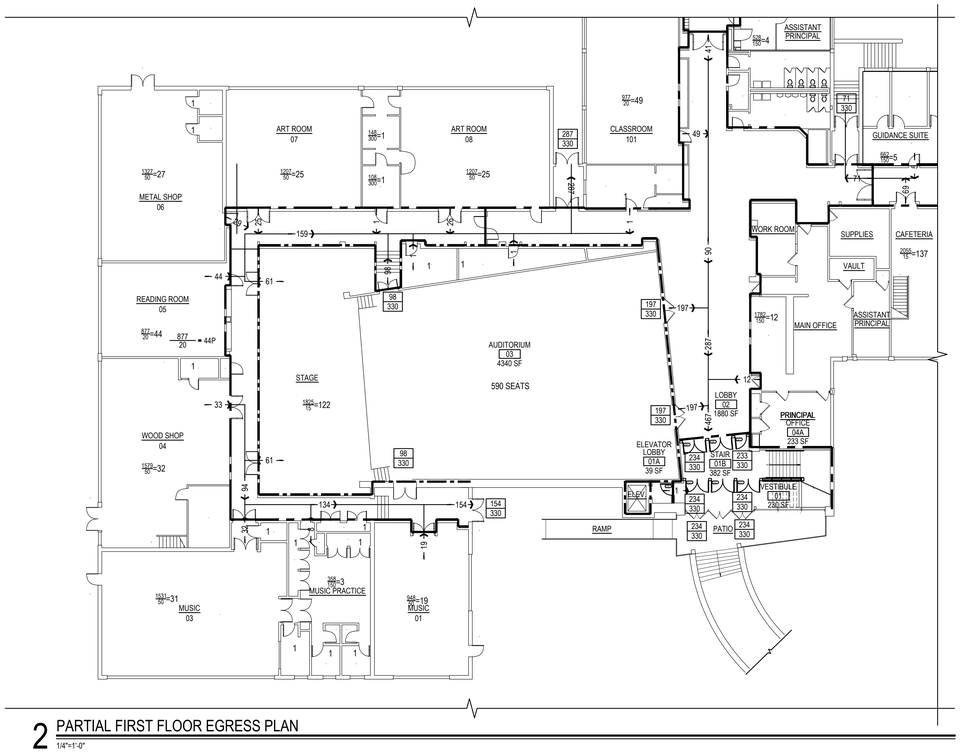




3 WALL TYPES
1 1/2"=1'-0"



2 PARTIAL SECOND FLOOR EGRESS PLAN
1/4"=1'-0"



2 PARTIAL FIRST FLOOR EGRESS PLAN
1/4"=1'-0"

LEGEND

GYMNASIUM — ROOM NAME
A103 — ROOM NUMBER

DOOR
18 — ACTUAL OCCUPANT LOAD
160 — OCCUPANT LOAD CAPACITY

126 AREA OF ROOM
100 @ 2P — OCCUPANT LOAD IN ROOM
AREA/PERSON

35 — DIRECTION OF TRAVEL WITH ACCUMULATED OCCUPANCY LOAD
145' — FURTHEST TRAVEL DISTANCE
ACCESSIBLE AREA OR EXIT
1 HOUR FIRE RATED WALL AND SMOKE BARRIER
EXISTING WALL
NEW WALL
DENOTES ACCESSIBLE THRESHOLD 1/2" MAX STEP WITH BEVELED THRESHOLD OR 1/4" WITHOUT BEVELED THRESHOLD

CODE INFORMATION

1. PROJECT DESCRIPTION:
INCORPORATION OF A SECURE VESTIBULE TO MEET GREENWICH PUBLIC SCHOOLS SECURITY STANDARDS. THIS VESTIBULE SEPARATES THE STAIRS FROM ITS CURRENT CONFIGURATION. THE 1 HOUR STAIR ENCLOSURE IS ADJUSTED ACCORDINGLY.

2. CLASSIFICATION OF WORK:
LEVEL 2 ALTERATION

DATE OF ORIGINAL CONSTRUCTION	1955
DATE OF ADDITION/ RENOVATION	1997
DATE OF CURRENT CONSTRUCTION	2026

3. APPLICABLE BUILDING CODES:

STATE BUILDING CODE W/SUPPLEMENT	2021 IBC/2022 CT
STATE PLUMBING CODE W/SUPPLEMENT	2021 IPC/2022 CT
STATE MECHANICAL CODE W/SUPPLEMENT	2021 IMC/2022 CT
STATE ELECTRICAL CODE W/SUPPLEMENT	2020 NFPA 70/2022 CT
STATE FIRE PREVENTION CODE	2021 NFPA 1 & 101/2022 CT
STATE HEALTH CODE	MOST CURRENT
OSHA	MOST CURRENT
SECTION 504	CURRENT
ADA	2010

4. CONSTRUCTION TYPE: (EXISTING, UNCHANGED) Type 3B

5. USE GROUP CLASSIFICATION:
(Primary) Use EDUCATION (E)
N.I.C. (Secondary) Use ASSEMBLY (A)

6. BUILDING AREA:

LOWER LEVEL	11,512+/- SF
FIRST FLOOR	76,977+/- SF
SECOND FLOOR	36,792+/- SF
TOTAL:	125,281+/- SF
SCOPE:	976 SF

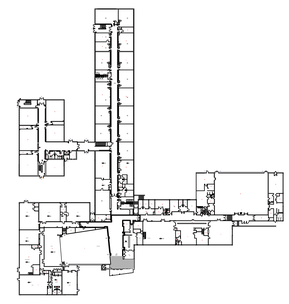
8. SPRINKLER PROTECTION: Entire Building NO

9. REQUIRED MEANS OF EGRESS: 0-49 MAX OCC. (REQ'D-) 1 Exits Provided 1

10. COMMON PATH OF TRAVEL: Non Sprinklered BLDG Distance 75'-0"

11. EXIT TRAVEL DISTANCE: non Sprinklered BLDG B Use Group 200'-0"

12. DEAD-END CORRIDOR: Non Sprinklered BLDG Distance 20'-0"



Project Title:
GREENWICH PUBLIC SCHOOLS - EASTERN MIDDLE SCHOOL
SECURE ENTRANCE

51 HENDRIE AVE
RIVERSIDE, CT 06878

SILVER PETRUCELLI + ASSOCIATES

3190 WHITNEY AVENUE HAMDEN CT 06518
311 STATE STREET NEW LONDON CT 06320
203 230 9007 silverpetrucelli.com

Revision:	Description:	Date:	Revised By:
	-	-	

Drawing Title: CODE PLANS & INFORMATION
Project Phase: ISSUED FOR BID
State Project Number: N/A

Date: 11/10/2026
Scale: 1/4" = 1'-0"
Drawn By: MHM
Project Number: 24-179

Drawing Number: G002

GENERAL NOTES:

1. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR IS RESPONSIBLE FOR THE VERIFICATION OF ALL EXISTING CONDITIONS, QUANTITIES, AND FOR NOTIFYING THE CONSULTANT OF ANY DISCREPANCIES PRIOR TO FINALIZING BID.

2. ABATEMENT AND REMEDIATION IN ALL AREAS WILL START WITH SELECTIVE DEMOLITION AND REMOVING MATERIALS AT THE CEILING LEVEL AND END WITH THE MATERIALS AT THE FLOORING LEVEL. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL COORDINATE AND PERFORM ENOUGH SELECTIVE DEMOLITION/DEMOLITION TO IDENTIFY/LOCATE AND ACCESS ALL MATERIALS TO BE REMOVED/ABATED/REMEDIATED. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR SHALL OPEN UP WALLS, AND CEILINGS TO CHECK FOR HIDDEN PIPING, DUCT, ETC. AS WELL AS DEMOLISHING MILLWORK, CABINETRY, NON-MOVEABLE OBJECTS, LAYER(S) OF FLOORING, WALLS, MATERIALS ATTACHED TO WALLS, ETC. TO LOCATE KNOWN AND POTENTIAL ASBESTOS CONTAINING MATERIALS. INTERIOR AND EXTERIOR SELECTIVE DEMOLITION/DEMOLITION AND PROBING MUST OCCUR THROUGHOUT THE WORK AREAS BEFORE CONTAINMENT CONSTRUCTION AND ABATEMENT CAN START. ASSUME THE ABATEMENT WORK WILL INCLUDE FULL CONTAINMENTS THROUGHOUT THE ENTIRE INTERIOR OF THE BUILDING. EXTERIOR ABATEMENT/REMEDIATION WILL BE EITHER PERFORMED IN CONTAINMENT (INTERIOR) OR THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL INSTALL POLYETHYLENE SHEETING ON THE INTERIOR OF THE BUILDING AND REMOVE MATERIALS FROM THE EXTERIOR. ALL GROUND AND ROOF SURFACES MUST ALSO BE PROTECTED WITH TARPS, PLYWOOD AND TWO LAYERS OF 10-MIL REINFORCED POLYETHYLENE SHEETING. THIS GROUND PROTECTION MUST EXTEND AT LEAST 20 FEET AWAY FROM THE BUILDING FOUNDATION (OR FARTHER - ENOUGH TO PREVENT BUILDING MATERIALS FROM TOUCHING UNPROTECTED GROUND AND FLOOR SURFACES). THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL PAY FOR ALL CONTAMINATION/REMEDIATION/ABATEMENT OF INTERIOR AND EXTERIOR SURFACES, INCLUDING GROUND SURFACES IF LANGAN DEEMS THEY HAVE CONTAMINATED THESE SURFACES. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL SUPPLY LIFTS, SCAFFOLDING, STAGING, ETC. TO LANGAN IN AREAS OF REMEDIATION/ABATEMENT UNTIL ALL VISUAL INSPECTIONS HAVE PASSED. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL PROVIDE TEMPORARY SHORING IN AREAS THAT REQUIRE IT.

3. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR/DEMOLITION CONTRACTOR SHALL ONLY USE HEAVY EQUIPMENT OPERATORS THAT HAVE PROPER ASBESTOS AND/OR HAZWOPER TRAINING WHEN DISTURBING/REMOVING/MOVING AND LOADING ASBESTOS, LEAD, AND PCB CONTAINING MATERIALS. ACCEPTABLE TRAINING FOR ASBESTOS CAN BE 32 OR 40 HOUR ASBESTOS WORKER/SUPERVISOR WITH ANNUAL REFRESHER TRAINING. 40 HOUR HAZWOPER TRAINING AND ANNUAL REFRESHER TRAINING IS REQUIRED FOR OPERATORS HANDLING LEAD AND/OR PCB CONTAINING/CONTAMINATED MATERIALS. ALL OPERATORS MUST ALSO HAVE CURRENT MEDICAL, FIT TEST DATA, AND WEAR RESPIRATORS DURING WORK. ALL CONTRACTORS MUST COMPLY WITH ALL APPLICABLE OSHA LEAD REGULATIONS AND THIS WORK (AND ALL CORRESPONDING OSHA REGULATION COMPLIANCE) IS INCLUDED IN THE BASE BID.

4. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR, THEIR SUBCONTRACTORS, WASTE TRANSPORTERS MUST SUBMIT LANDFILL INFORMATION TO LANGAN AND THE OWNER PRIOR TO THE SHIPMENT OF ANY WASTE. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR(S)/HAULER(S) CANNOT SHIP WASTE UNTIL LANGAN AND THE OWNER HAVE APPROVED THE LANDFILL THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR/HAULER IS/ARE PROPOSING TO SHIP THE WASTE TO. ALL PCB TCLP SAMPLING OF THE WASTE MUST BE PERFORMED BY THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR (IF TESTING IS APPROVED BY LANGAN AND THE OWNER) WITH LANGAN PRESENT AND THE RESULTS MADE AVAILABLE TO LANGAN AND THE OWNER PRIOR TO WASTE SHIPMENT. LANGAN MAY PERFORM ADDITIONAL TCLP SAMPLING TO CONFIRM THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR'S RESULTS. LANGAN WILL PERFORM THE LEAD TCLP SAMPLING FOR CLASSIFICATION OF THE DEMOLITION AND ABATEMENT WASTE. PLEASE SEE THE ASBESTOS, PCB, AND LEAD-BASED PAINT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS AND CONTRACTORS LIABILITY.

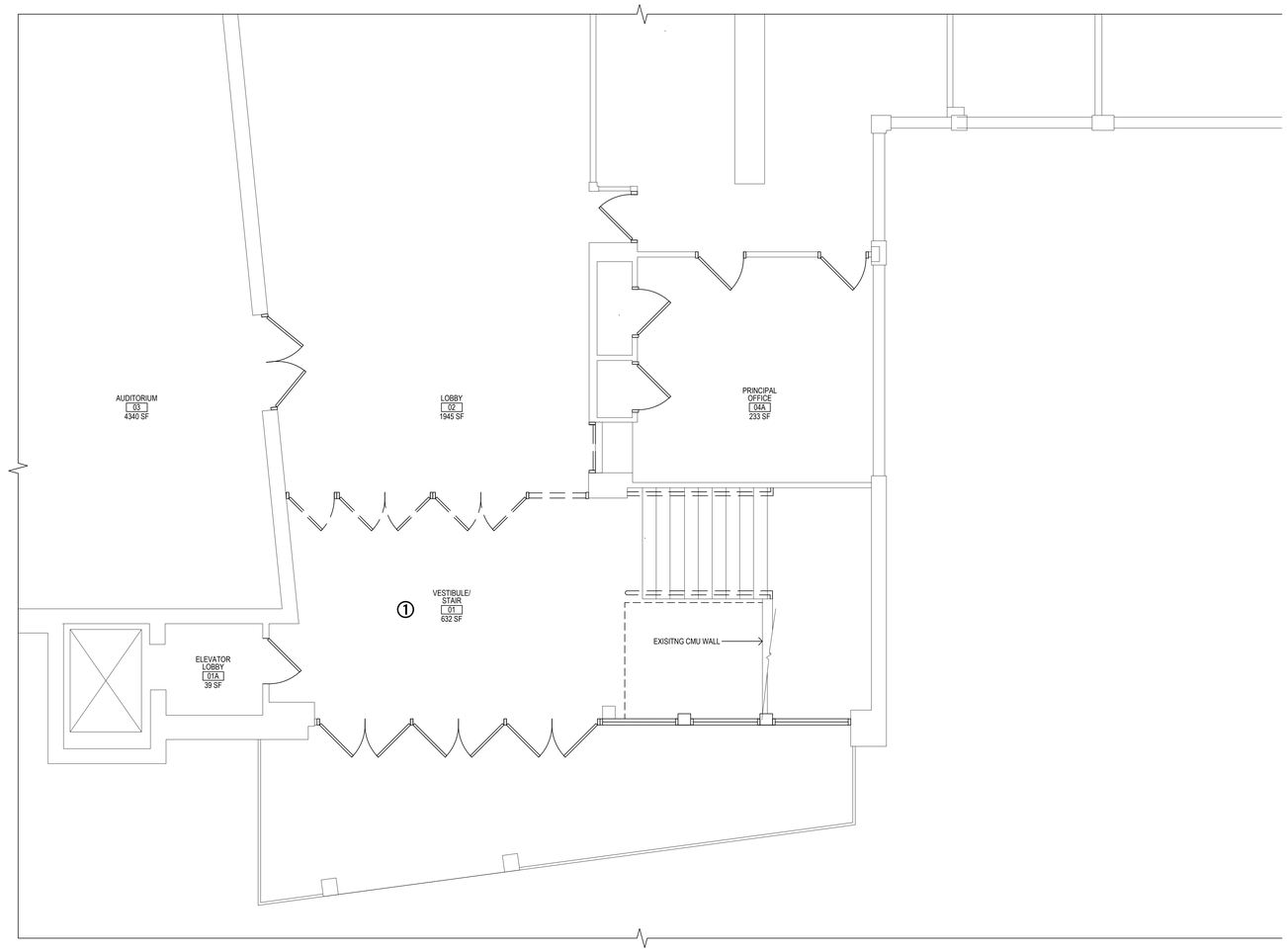
5. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR, THEIR SUBCONTRACTORS, WASTE TRANSPORTERS AND/OR LANDFILL(S) DO NOT HAVE PERMISSION TO TAKE/ANALYZE BUILDING MATERIALS FOR PCB CONTENT/ CONCENTRATIONS WITHOUT WRITTEN PERMISSION FROM THE BUILDING OWNER PRIOR TO SUCH SAMPLING. SHOULD THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR OR OTHER PARTIES LISTED ABOVE TAKE/ANALYZE PCB SAMPLES WITHOUT THE OWNER'S PERMISSION AND PCB'S ARE FOUND TO BE >1 PPM, THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL BE RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH THE ABATEMENT/ REMEDIATION/REPLACEMENT OF ALL THE INTERIOR/EXTERIOR BUILDING MATERIALS AND ADJACENT SURFACES, INCLUDING SOIL/ASPHALT/CONCRETE/ETC. AS WELL AS ALL COSTS ASSOCIATED WITH PROJECT DELAYS, ATTORNEY FEES FOR ALL PARTIES AFFECTED AND ALL COSTS RESULTING FROM CT DEEP/EPA REQUIREMENTS THAT MAY OCCUR AS A RESULT.

6. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL BE RESPONSIBLE FOR HIRING AN ENGINEER AND OTHER APPROPRIATE PERSONNEL TO ENSURE THAT ALL REQUIRED SELECTIVE DEMOLITION AND DEMOLITION ACTIVITIES ARE SAFE TO PERFORM FOR ALL PERSONNEL ON SITE. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR(S) WILL BE FINANCIALLY RESPONSIBLE FOR ANY DAMAGE THAT MAY OCCUR TO THE SITE, ON-SITE PERSONNEL, FINES, PENALTIES, ETC. THEY WILL ALSO BE RESPONSIBLE FOR PAYING/REIMBURSING ALL LEGAL FEES/COSTS FOR ALL PARTIES INVOLVED WITH THE PROJECT SHOULD SELECTIVE DEMOLITION OR DEMOLITION ACTIVITIES CAUSE INJURY OR DEATH TO ANY PERSONS ON SITE.

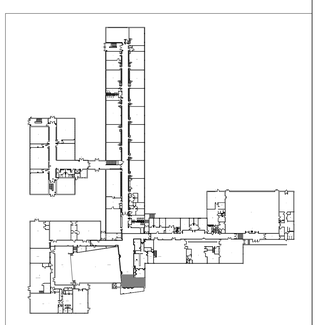
7. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR IS RESPONSIBLE FOR PROVIDING TEMPORARY WATER, POWER, AND HEAT AS NEEDED AT THE SITE (24 HOURS A DAY). TEMPORARY LIGHTING WITHIN THE WORK AREAS MUST BE CONNECTED TO GROUND FAULT CIRCUIT INTERRUPTER (GFCI) POWER PANELS INSTALLED BY A STATE OF CONNECTICUT LICENSED ELECTRICIAN AND LOCATED OUTSIDE OF THE WORK AREAS. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR SHALL BE RESPONSIBLE FOR PAYING FOR THE USE OF POWER AND WATER UNLESS THE OWNER AGREES IN WRITING TO PAY FOR THESE UTILITIES. IT SHALL ALSO BE THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR'S RESPONSIBILITY TO PROVIDE ALL FIXED AND TEMPORARY CONNECTIONS AND HOOK-UPS AS WELL AS OBTAINING PERMITS AND PAYING ALL FEES FOR MAKING SUCH SERVICES AVAILABLE FOR HIS WORK AS IS NECESSARY. ALL POWER AND WATER MUST BE SUPPLIED 24 HOURS A DAY THROUGHOUT THE ABATEMENT PROJECT. CT DPH WILL BE NOTIFIED IMMEDIATELY IF ACTIVE CONTAINMENTS DO NOT HAVE SUFFICIENT NEGATIVE PRESSURE THROUGHOUT THE ABATEMENT PROCESS UNTIL ACCEPTABLE REOCCUPANCY AIR RESULTS ARE RECEIVED. THE USE OF PORTABLE GENERATORS WILL REQUIRE 24 HOURS A DAY, 7 DAYS A WEEK CONTINUOUS OPERATION IF NEGATIVE AIR MACHINES IN CONTAINMENTS ARE POWERED BY THEM. THIS CONTINUOUS OPERATION MUST REMAIN IN PLACE FROM THE TIME THE PRE-ABATEMENT VISUAL IS COMPLETED UP UNTIL CLEARANCE RE-OCCUPANCY SAMPLING RESULTS HAVE PASSED. THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR WILL PAY THE OWNER A $2,500 PENALTY SHOULD THE POWER BE FOUND TO NOT BE RUNNING THE NEGATIVE AIR MACHINES IN ACTIVE ABATEMENT CONTAINMENTS. THIS PENALTY WILL APPLY DAILY AND THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR IS ALSO RESPONSIBLE FOR PAYING ALL CT DPH FINES THAT MAY BE IMPOSED ON THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR AND OWNER.

HAZARDOUS BUILDING MATERIALS ABATEMENT NOTES (SEE ASBESTOS ABATEMENT SPECIFICATION FOR ADDITIONAL INFORMATION NOT INCLUDED ON DRAWINGS)

① THE HAZARDOUS BUILDING MATERIALS ABATEMENT CONTRACTOR SHALL REMOVE AND DISPOSE OF ASBESTOS CONTAINING PIPE AND PIPE FITTING INSULATION AS ACM.



FIRST FLOOR HAZARDOUS BUILDING MATERIALS ABATEMENT PLAN



Project Title:

GREENWICH PUBLIC SCHOOLS - EASTERN MIDDLE SCHOOL SECURE ENTRANCE

51 HENDRIE AVE
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Revision:	Description:	Date:	Revised By:
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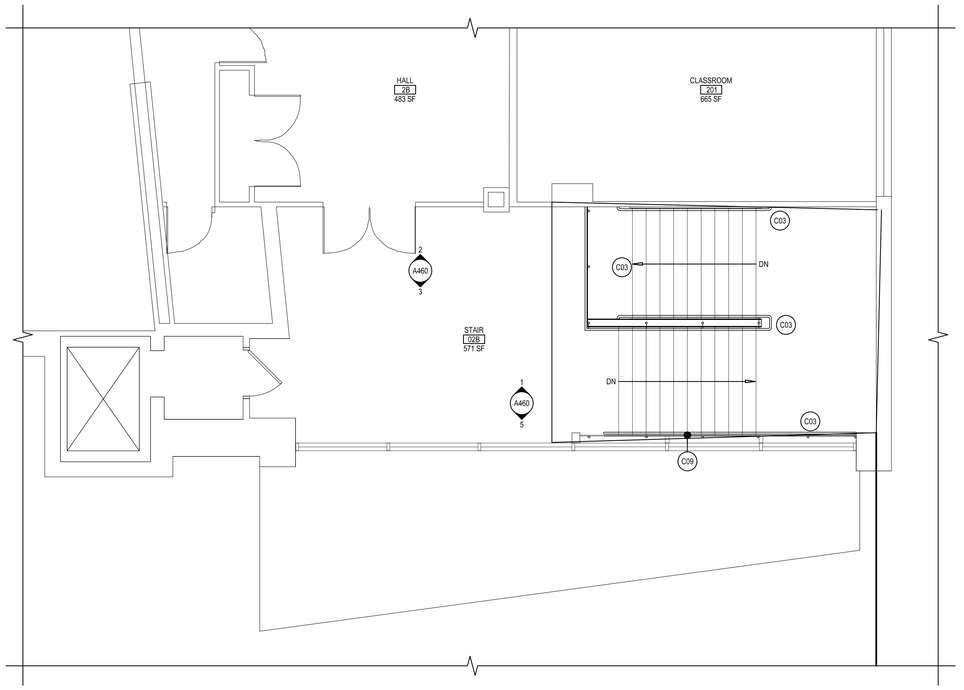
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FIRST FLOOR HAZARDOUS BUILDING MATERIALS ABATEMENT PLAN

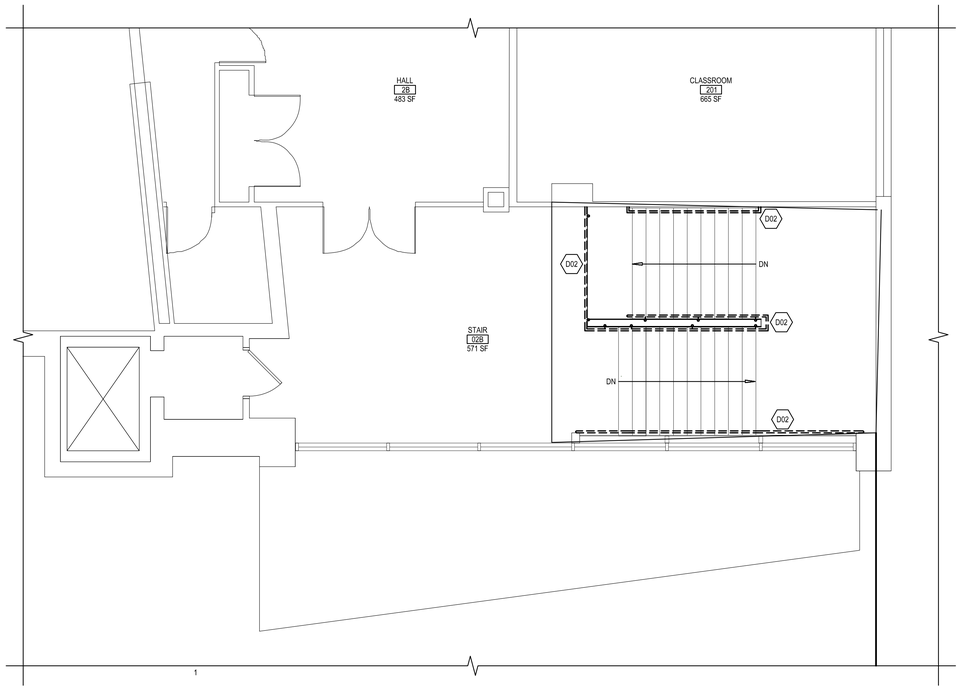
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Scale:
Drawn By: HHG/MM
Project Number: 24-179

Drawing Number: HBM-01

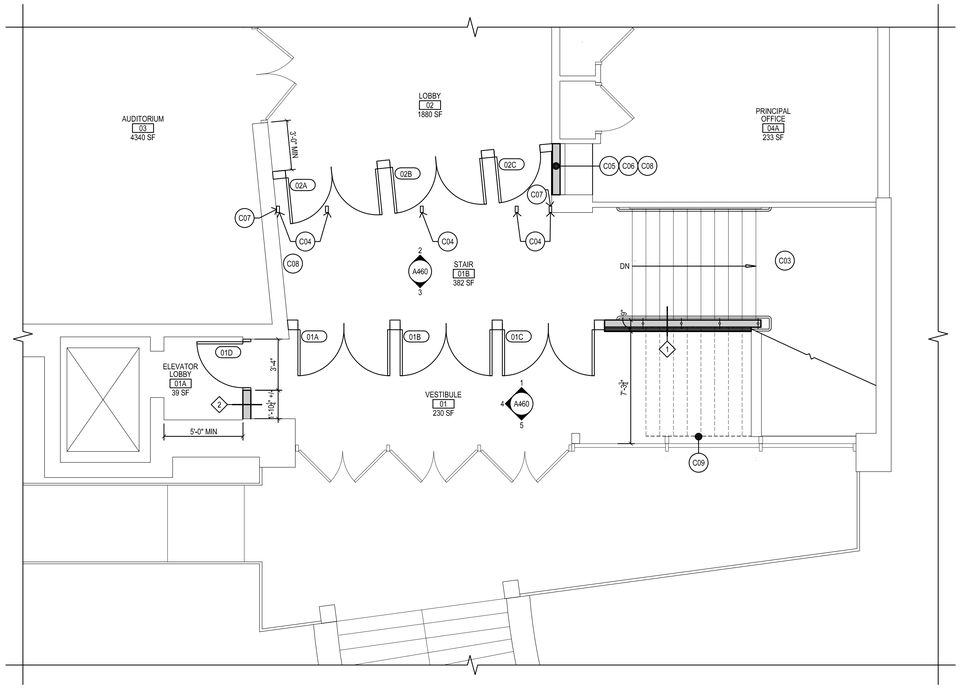
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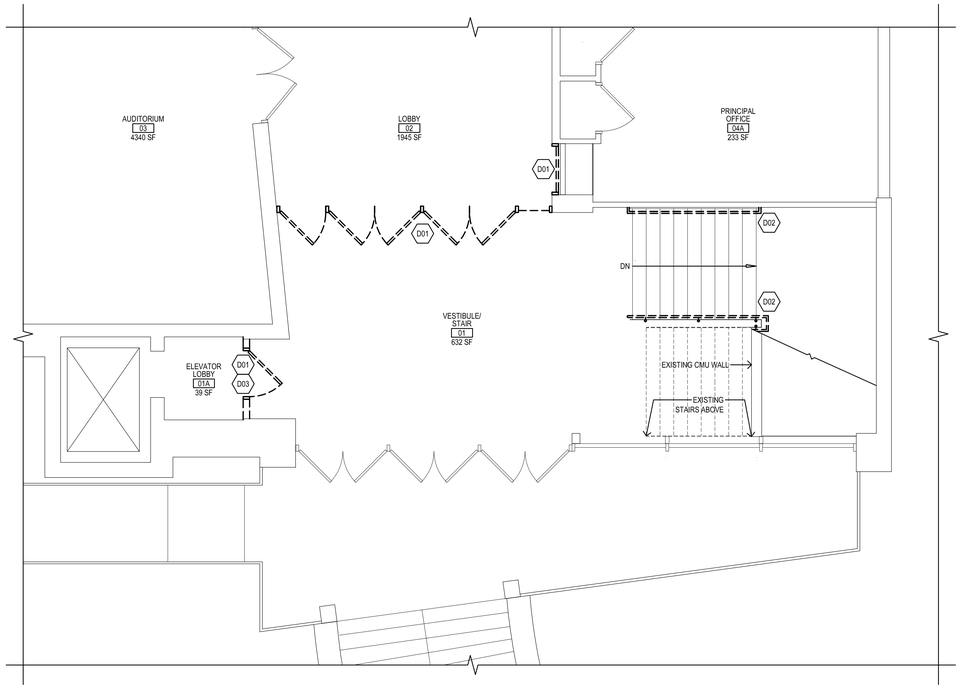
4 SECOND FLOOR PLAN
1/4"=1'-0"



3 SECOND FLOOR DEMOLITION PLAN
1/4"=1'-0"



2 FIRST FLOOR PLAN
1/4"=1'-0"



1 FIRST FLOOR DEMOLITION PLAN
1/4"=1'-0"

0 2'-0" 4'-0" 6'-0" 10'-0"
GRAPHIC SCALE - 1/4" = 1'-0"

SYMBOL LEGEND

- EXISTING WALL TO REMAIN
- EXISTING WALL TO BE REMOVED
- EXISTING DOOR TO REMAIN
- EXISTING DOOR TO BE REMOVED
- NEW DOOR, SEE DOOR SCHEDULE
- ## — DOOR NUMBER, SEE DOOR SCHEDULE
- D# — KEY NOTE - DEMOLITION
- C01 — KEY NOTE - CONSTRUCTION

GENERAL NOTES

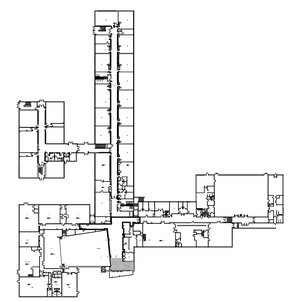
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2. UNLESS OTHERWISE INDICATED IN THE CONSTRUCTION DOCUMENTS AS BEING NOT IN CONTRACT (N.I.C.) OR EXISTING; ALL ITEMS, MATERIALS AND INSTALLATION OF SAME ARE A PART OF THE CONTRACT DEFINED BY THE CONSTRUCTION DOCUMENTS.
3. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL ACCESSORIES, COMPONENTS AND ASSEMBLIES REQUIRED FOR THE WORK SHOWN. GENERAL CONTRACTOR SHALL SUBMIT A DETAILED PROJECT SCHEDULE AND IS SOLELY RESPONSIBLE FOR CONSTRUCTION SEQUENCING, METHODS AND TECHNIQUES.
4. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR PAYING FOR AND OBTAINING ALL PERMITS, INSPECTIONS, REQUIRED TESTS AND UTILITY CONNECTIONS, TERMINATIONS, AND CAPPING UNLESS OTHERWISE NOTED.
5. GENERAL CONTRACTOR SHALL PROVIDE AND IS SOLELY RESPONSIBLE FOR PUBLIC & EMPLOYEE PROTECTION AS NECESSARY AND AS REQUIRED BY THE CODES, ORDINANCES AND REGULATIONS OF GOVERNMENTAL AGENCIES HAVING JURISDICTION AT THE PROJECT PLACE.
6. ANY WORK INVOLVING ALTERATION TO EXISTING BUILDING UTILITIES & WHICH REQUIRE UTILITY SHUT DOWN, SHALL BE COORDINATED WITH THE OWNER AND SHALL REQUIRE A MIN OF (5) DAYS NOTICE (OR PER ALL REQUIREMENTS).
7. IN THE EVENT OF DISCREPANCIES IN THE DRAWINGS, THE COSTLIER OR MORE RESTRICTIVE CONDITIONS SHALL BE DEEMED THE CONTRACT REQUIREMENT, UNLESS OTHERWISE STATED IN WRITING, FROM THE OWNER OR OWNER'S REPRESENTATIVE. ANY DISCREPANCIES SHOULD IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ARCHITECT.
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10. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO KEEP THE PREMISES CLEAN OF DEBRIS, RUBBISH, EXCESS MATERIALS, ETC. RESULTING FROM THE WORK OF THIS CONTRACT. OFFICE AREAS SHALL BE BROOM CLEAN EACH WORK DAY.
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12. AS REQUIRED BY CODE, EACH CONTRACTOR AND EACH SUBCONTRACTOR SHALL OBTAIN REQUIRED INSPECTION OF THAT PORTION OF WORK.
13. ALL AREAS OF DEMOLITION MUST BE PATCHED, REPAIRED AND INFILLED TO MATCH EXISTING / ADJACENT CONDITIONS.
14. REFER TO ME/P DRAWINGS FOR ADDITIONAL DEMOLITION AND NEW WORK COORDINATION. COORDINATE ALL TRADES.

DEMOLITION KEY NOTES

1. REMOVE WOOD DOORS, FRAME, GLAZING, BLOCKING, TRANSOMS, THRESHOLD, HARDWARE & ASSOCIATED COMPONENTS.
2. REMOVE EXISTING HANDRAILS, GUARDRAILS AND ASSOCIATED COMPONENTS.
3. REMOVE EXISTING INTERIOR STUD WALLS AS INDICATED ON DRAWINGS, INCLUDING ALL BASE, TRIM AND WALL MOUNTED DEVICES. REFER TO ME/P DRAWINGS FOR ADDITIONAL DEMOLITION COORDINATION.

CONSTRUCTION KEY NOTES

1. DOOR/FRAME SYSTEM:
   - DOOR, FRAME, GLAZING, HARDWARE AND ASSOCIATED COMPONENTS (PER MANUFACTURER); SEE DOOR/FRAME TYPES, SCHEDULE, DETAILS AND PROJECT MANUAL FOR ADDITIONAL INFORMATION.
2. FINISH WALLS (SEE PARTITION TYPES ON G002):
   - PATCH & REPAIR ALL EXISTING WALLS (MATCH IN-KIND) AS REQUIRED WHERE DEMO & NEW AFFECT EXISTING.
3. NEW HANDRAILS AND GUARD RAILS:
   - SEE DETAILS ON A600
   - PAINT EXISTING STAIR RISERS, STRINGERS AND ALL NEW GUARDRAILS AND HANDRAILS
4. PATCH EXISTING TERRAZZO FLOORING AT REMOVAL OF DOORS FRAME.
5. AT REMOVAL OF DOOR, INFILL WALL TO MATCH EXISTING: 8" CMU, WOOD PANELING, PAINT.
6. PROVIDE 1 HOUR FIRE SAFING FROM TOP OF WALL TO DECK AT STAIR ENCLOSURE.
7. PATCH EXISTING WALLS AT REMOVAL OF DOOR FRAMES TO MATCH ADJACENT EXISTING CONDITIONS.
8. PROVIDE INTUMESCENT PAINT AT EXISTING AND NEW WOOD PANELING WITHIN STAIR 01B, SEE PROJECT MANUAL.
9. WELD ADDITIONAL STEEL TO EXTEND THE STRINGER TO RECEIVE CEILING FRAMING. SEE DETAILS D&E/A250.



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Revision:	Description:	Date:	Revised By:
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Drawing Title: DEMOLITION PLAN & FLOOR PLAN

Project Phase: ISSUED FOR BID

State Project Number: N/A

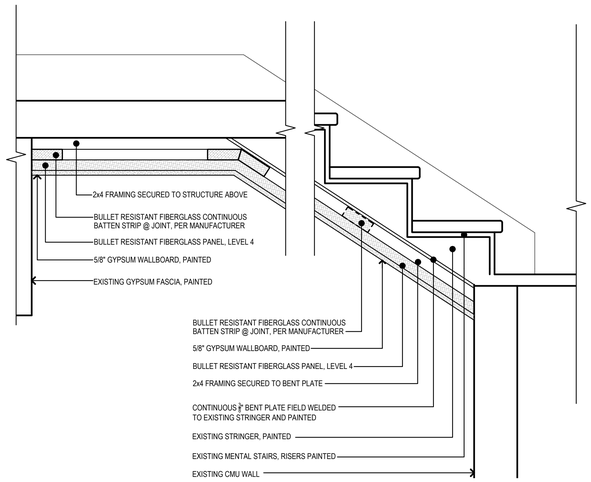
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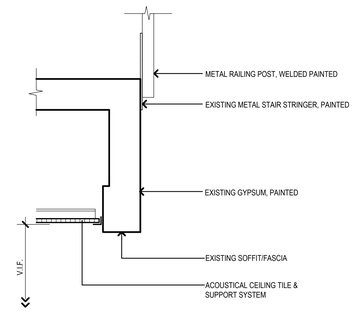
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Project Number: 24-179

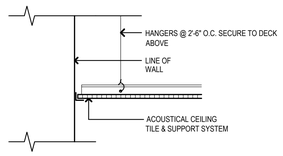
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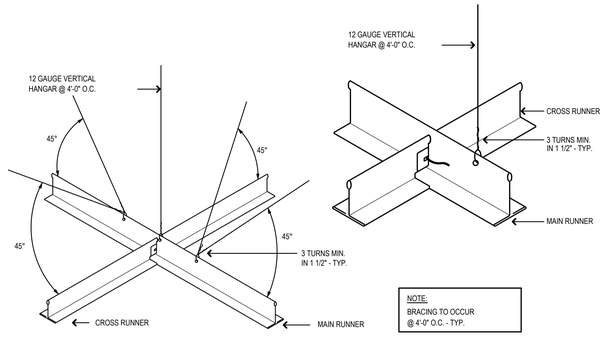
D CEILING DETAIL
1-1/2"=1'-0"



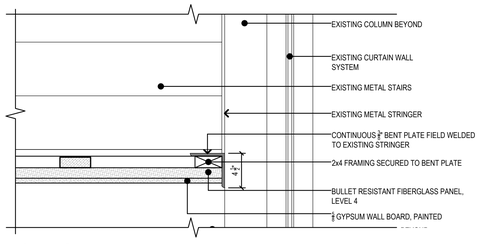
C CEILING DETAIL
1-1/2"=1'-0"



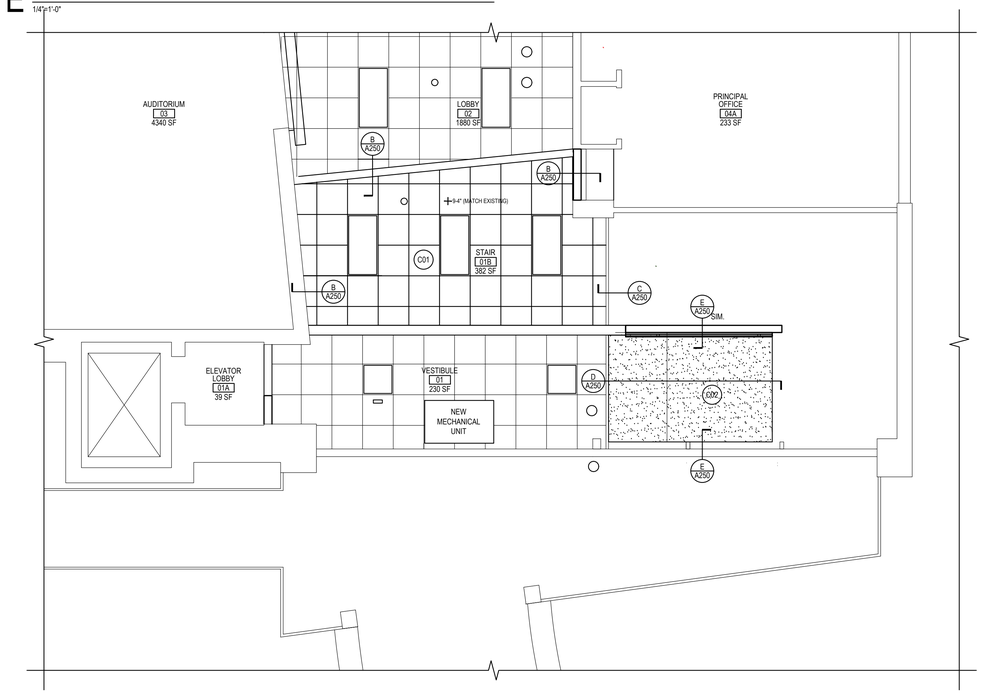
B CEILING DETAIL
1-1/2"=1'-0"



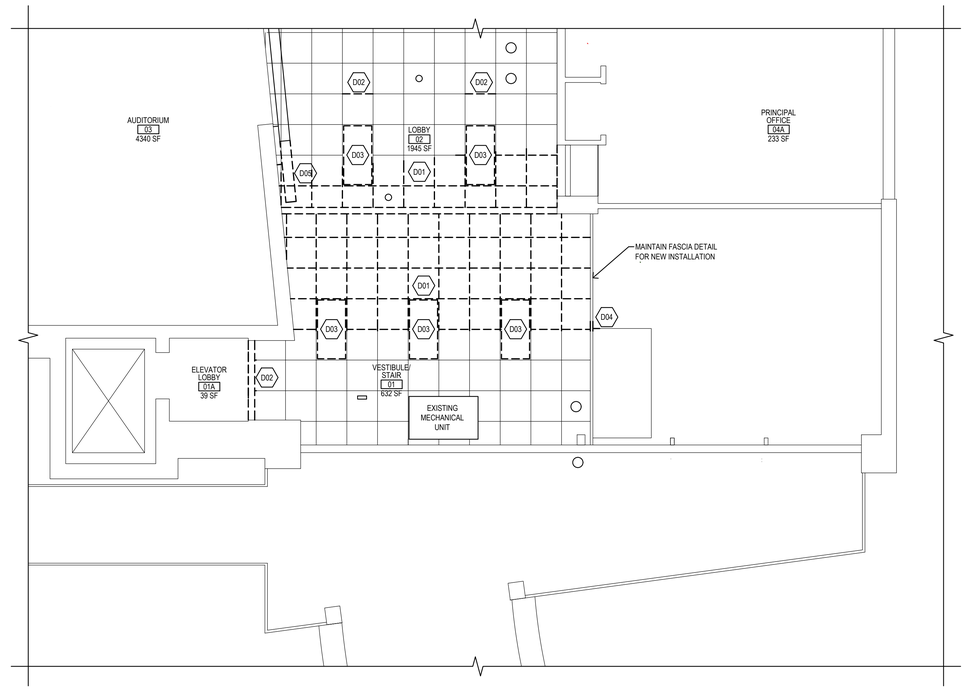
A CEILING DETAIL
1-1/2"=1'-0"



E CEILING DETAIL
1/4"=1'-0"



2 REFLECTED CEILING PLAN
1/4"=1'-0"



1 REFLECTED CEILING DEMOLITION PLAN
1/4"=1'-0"

0 2'-0" 4'-0" 6'-0" 10'-0"
GRAPHIC SCALE - 1/4" = 1'-0"

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14. REFER TO M/E/P DRAWINGS FOR ADDITIONAL DEMOLITION AND NEW WORK COORDINATION. COORDINATE ALL TRADES.

R.C.P. SYMBOL LEGEND

- 2' X 2' SUSPENDED ACOUSTICAL CEILING SYSTEM, SEE FINISH SCHEDULE AND PROJECT MANUAL.
- GYPSUM WALL BOARD CEILING OR SOFFIT, PAINTED.
- LIGHTING FIXTURES, SEE ELECTRICAL LIGHTING DRAWINGS.
- LIGHTING FIXTURES, SEE ELECTRICAL LIGHTING DRAWINGS.
- SUPPLY AND RETURN CEILING COVERS, SEE MECHANICAL DRAWINGS.
- SPRINKLER HEAD
- (9'-4") INDICATES CEILING HEIGHT

R.C.P. GENERAL NOTES

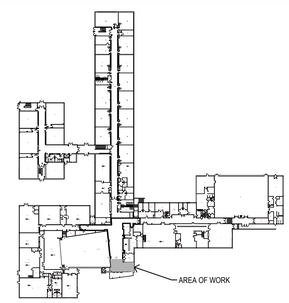
1. FOR ADDITIONAL LIGHTING INFORMATION - SEE ELECTRICAL DRAWINGS.
2. FOR ADDITIONAL MECHANICAL INFORMATION - SEE MECHANICAL DRAWINGS.
3. FOR CEILING TYPE OF TILE OR PANEL - SEE PROJECT MANUAL.
4. FOR SEISMIC BRACING AT ALL A.C.T. - SEE DETAIL A/A250
5. REMOVE ANY ABANDONED FRAMING THAT MAY BE ABOVE EXISTING CEILINGS IN SCOPE OF WORK.
6. COORDINATE WORK WITH EXISTING STRUCTURE ABOVE.

DEMOLITION KEYNOTES

1. REMOVE EXISTING ACOUSTIC CEILING TILES AND GRIDS INCLUDING ALL CEILING MOUNTED DEVICES. REFER TO M/E DRAWINGS FOR ADDITIONAL DEMOLITION INFORMATION.
   - SUPPORT REMAINING CEILING AS REQUIRED.
2. REMOVE LIMITED PORTION OF CEILING TILES AND GRID AS REQUIRED TO RECEIVE NEW WORK.
3. REMOVE EXISTING LIGHTS AND DEVICES, SALVAGE FOR REUSE.
   - SEE ELECTRICAL DRAWINGS FOR MORE INFORMATION.
4. REMOVE PORTION OF FASCIA/SOFFIT, CEILING TO RECEIVE NEW WORK
5. REMOVE A PORTION OF THE WALL MOUNTED COVE LIGHTING INCLUDING WOOD HOUSING .
   - SEE ELECTRICAL DRAWINGS FOR MORE INFORMATION.

CONSTRUCTION NOTES

1. NEW 2X2 ACT CEILING SYSTEM:
   - SEE DETAILS
   - SEE ELECTRICAL AND MECHANICAL FOR ADDITIONAL INFORMATION
2. INSTALL BULLET RESISTANT FIBERGLASS PANEL AND GYPSUM WALL BOARD, PAINTED, TO UNDERSIDE OF METAL STAIRS. WELD EXTENSION TO METAL STRINGER.
   - SEE DETAILS D & E/A250



Project Title:

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Revision:	Description:	Date:	Revised By:
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Drawing Title: REFLECTED CEILING PLANS & DETAILS

Project Phase: ISSUED FOR BID

State Project Number: N/A

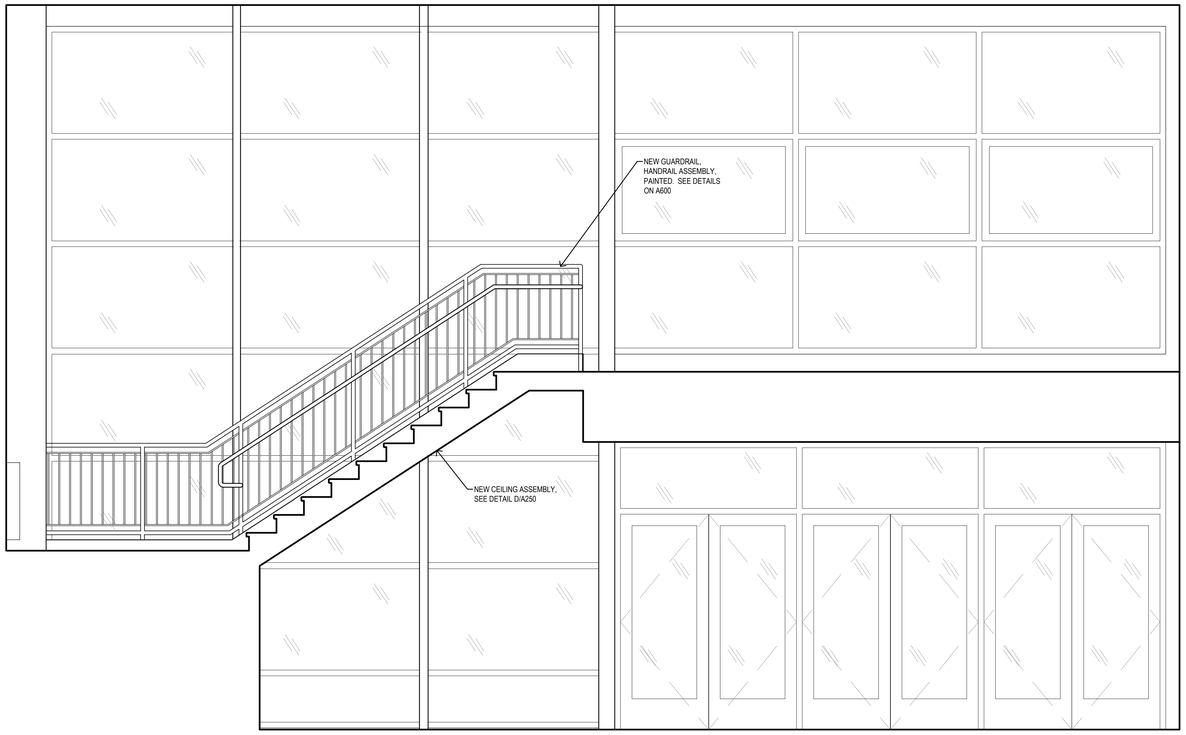
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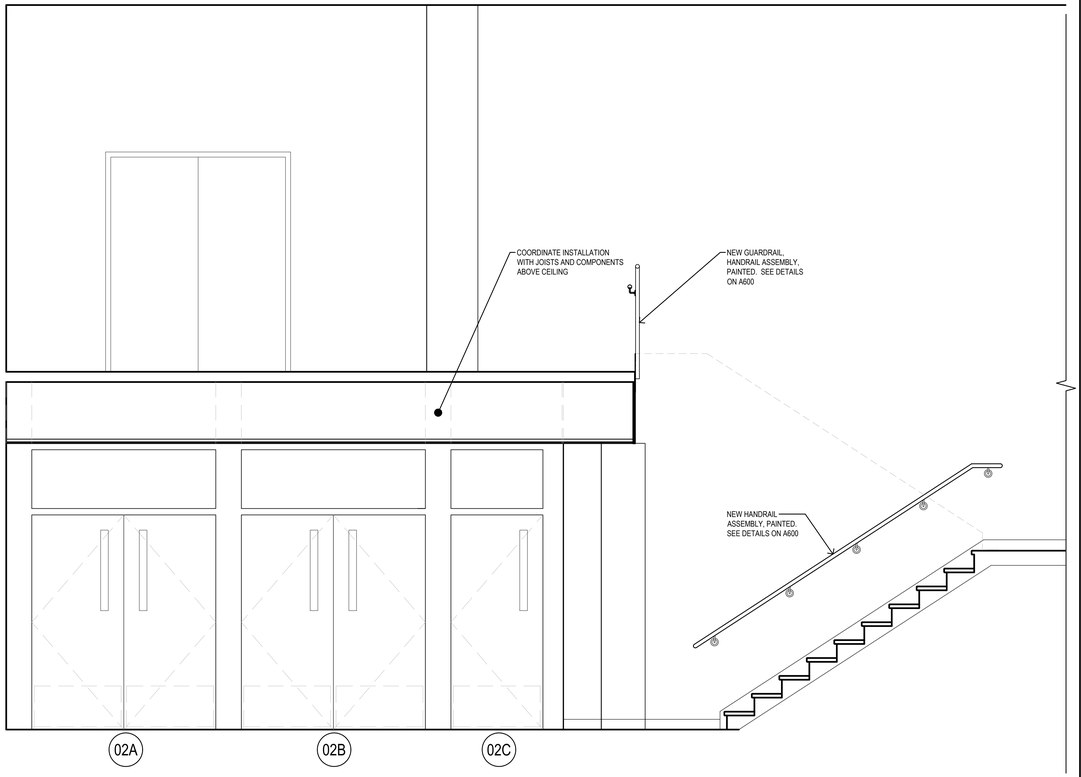
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Project Number: 24-179

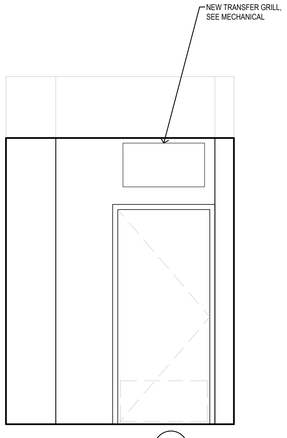
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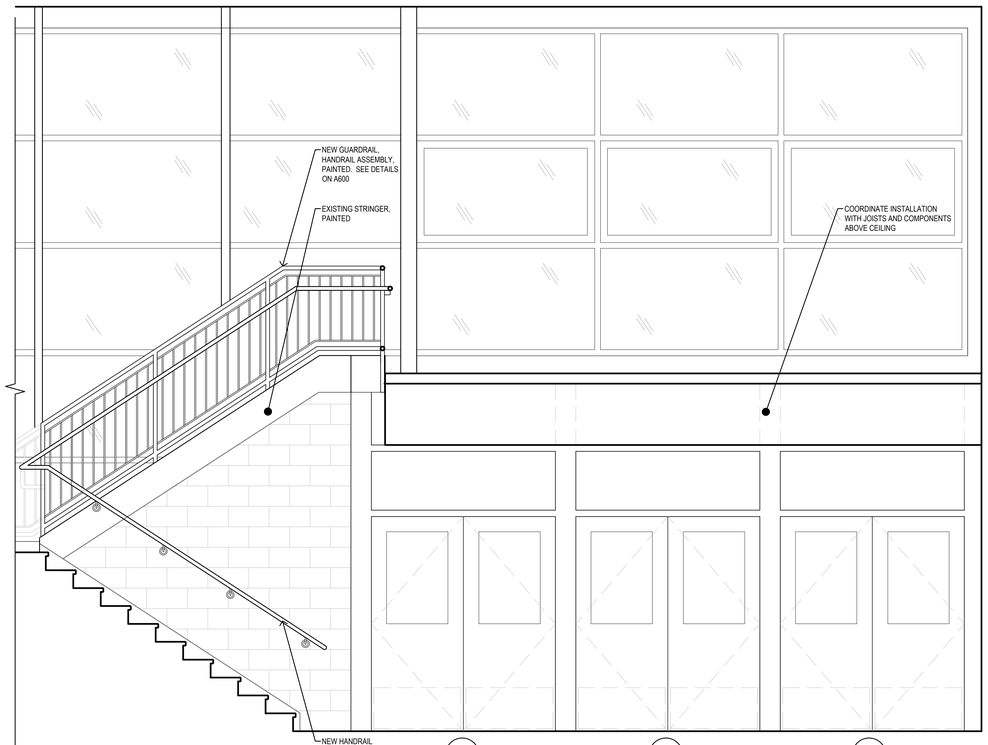
5 INTERIOR ELEVATIONS
1/2"=1'-0"



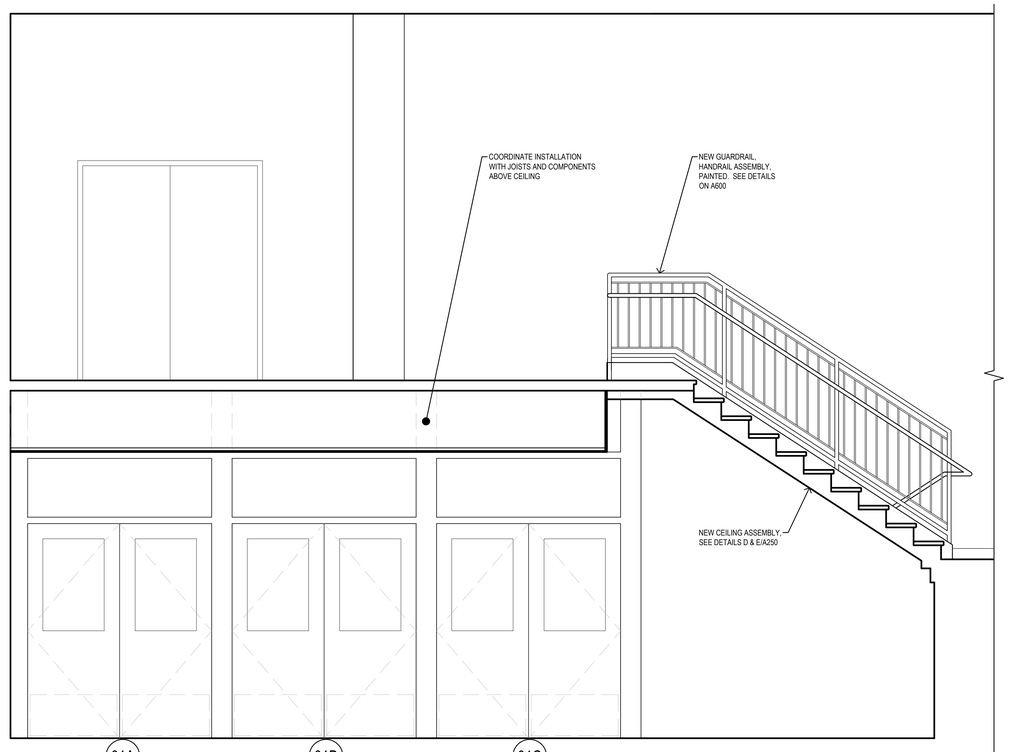
2 INTERIOR ELEVATIONS
1/2"=1'-0"



4 INTERIOR ELEVATIONS
1/2"=1'-0"



3 INTERIOR ELEVATIONS
1/2"=1'-0"



1 INTERIOR ELEVATIONS
1/2"=1'-0"

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Revision:	Description:	Date:	Revised By:
	-	-	

Drawing Title: INTERIOR ELEVATIONS

Project Phase: ISSUED FOR BID

State Project Number: N/A

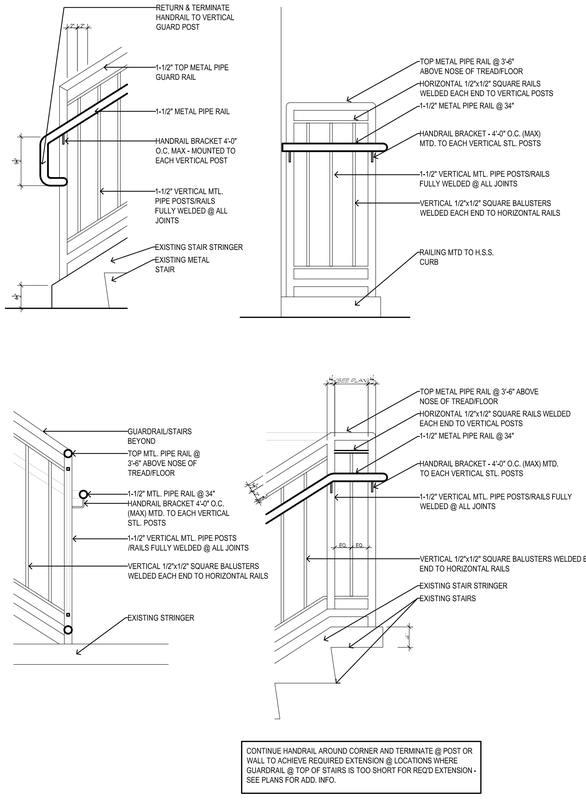
Date: 11/10/2026

Scale: 1/2" = 1'-0"

Drawn By: MHM

Project Number: 24-179

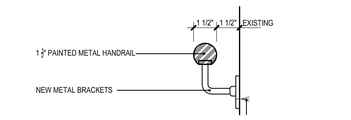
Drawing Number: A460



7 GUARDRAIL HANDRAIL DETAILS
1"=1'-0"

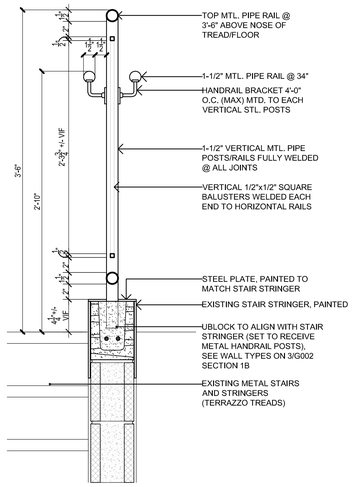


6 HANDRAIL DETAIL
1"=1'-0"

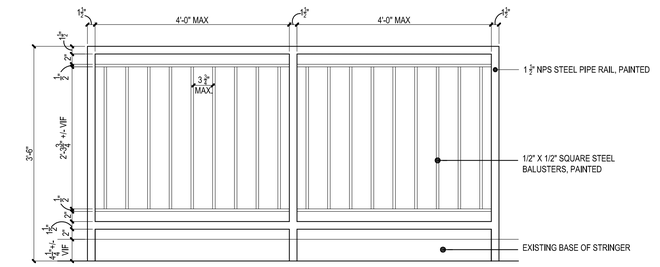


4 HANDRAIL DETAIL
3"=1'-0"

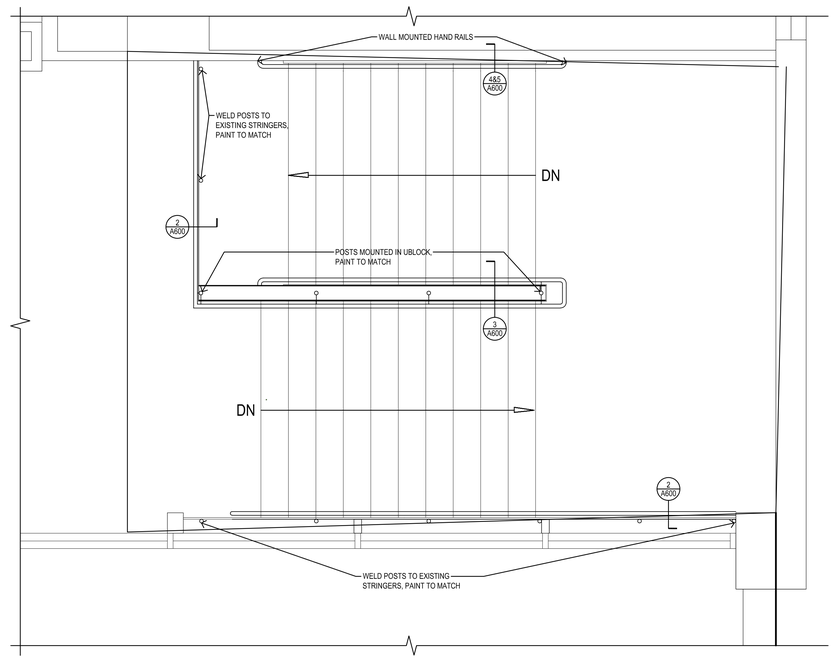
5 HANDRAIL DETAIL
3"=1'-0"



3 GUARDRAIL/POST DETAIL
1 1/2"=1'-0"



2 TYPICAL GUARD RAIL DETAIL
1"=1'-0"



1 ENLARGED STAIR FLOOR PLAN
1/4"=1'-0"

Project Title:

GREENWICH PUBLIC SCHOOLS - EASTERN MIDDLE SCHOOL SECURE ENTRANCE

51 HENDRIE AVE
RIVERSIDE, CT 06878

SILVER PETRUCELLI + ASSOCIATES

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311 STATE STREET NEW LONDON CT 06320
203 230 9007 silverpetrucelli.com

Revision:	Description:	Date:	Revised By:
	-	-	

Drawing Title: RAILING DETAILS

Project Phase: ISSUED FOR BID

State Project Number: N/A

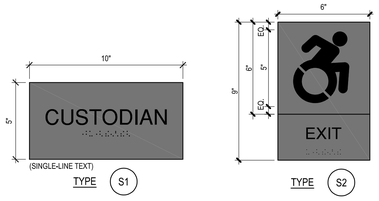
Date: 11/10/2026

Scale: AS NOTED

Drawn By: MHM

Project Number: 24-179

Drawing Number: A600

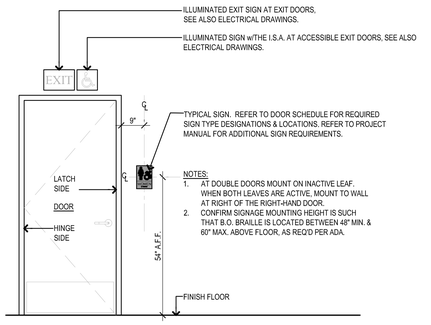


SIGNAGE NOTES:

1. SIGNS SHALL COMPLY WITH CURRENT BUILDING CODE, ANSI STANDARDS, ADA REGULATIONS & GUIDELINES, AND ALL OTHER APPLICABLE REGULATIONS.
2. TEXT ON SIGNS SHALL BE COORDINATED IN FIELD TO REFLECT ROOM USE, AND SHALL BE APPROVED BY ARCHITECT AND OWNER PRIOR TO FABRICATION.
3. REFER TO TYPICAL SIGN DETAIL AND TYPICAL SIGN MOUNTING DETAILS ON THIS DRAWING.
4. SIGNAGE SHALL BE PROVIDED WITH GRADE 2 BRAILLE.

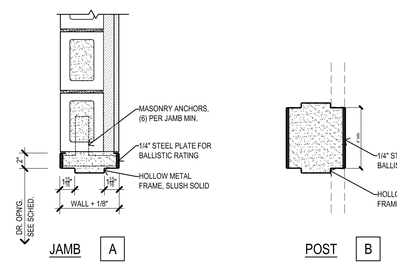
3 SIGNAGE TYPES

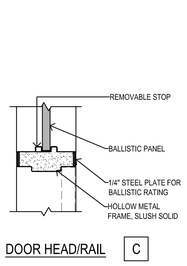
1/2"=1'-0"

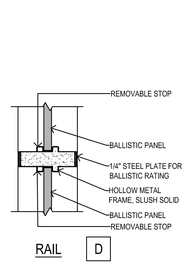


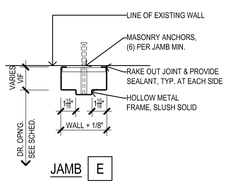
4 SIGNAGE MOUNTING

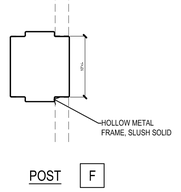
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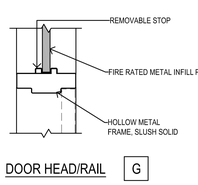


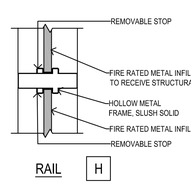


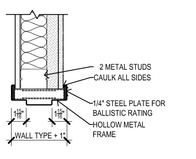


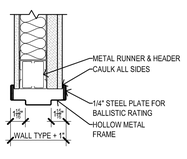


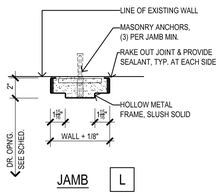


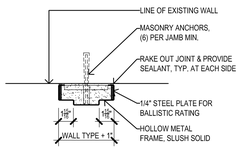


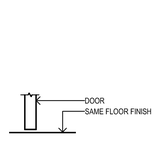












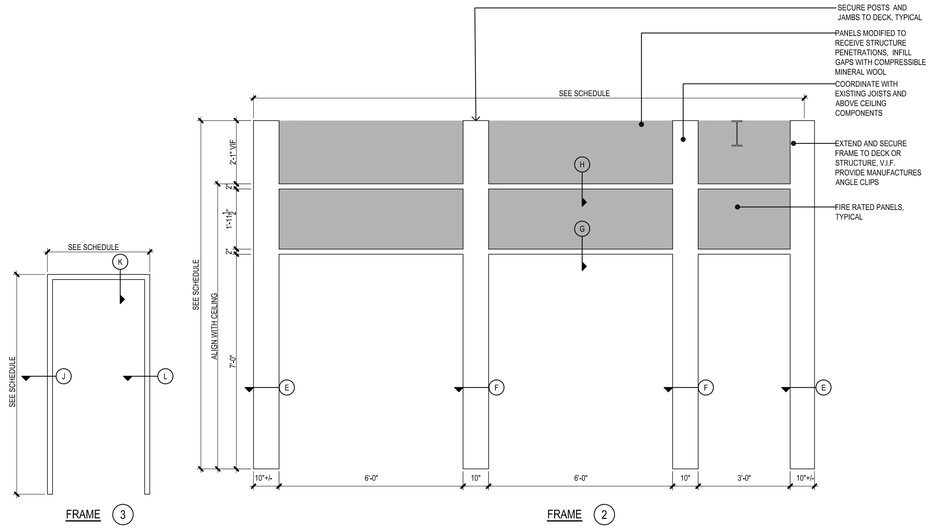
5 FRAME DETAILS

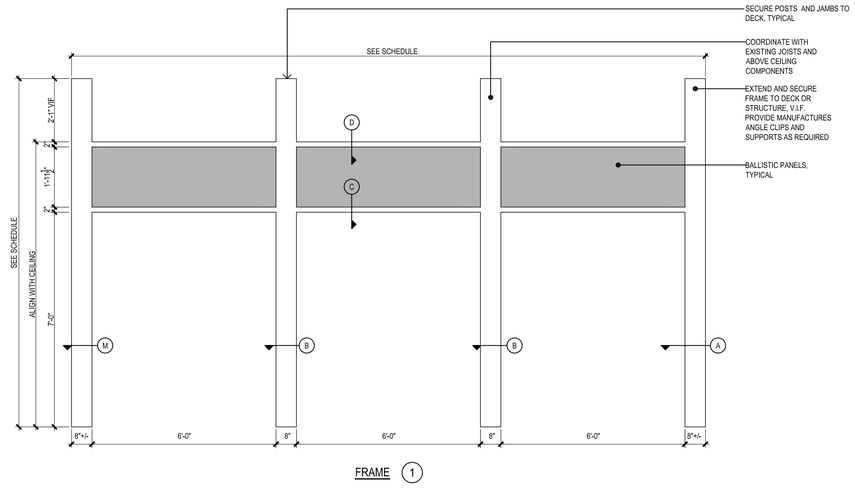
1 1/2"=1'-0"

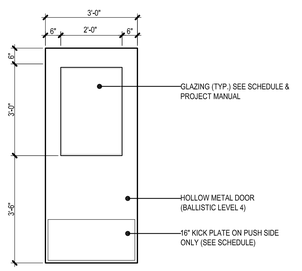
1. AT FIRE RATED WALLS SEAL ALL DUCT, PIPE, JOIST AND MISCELLANEOUS PENETRATIONS THROUGH WALL WITH SAFING INSULATION/PUTTY ASSEMBLY AS REQUIRED TO MEET FIRE RATING, TO RESIST THE PASSAGE OF SMOKE AND TO MAINTAIN MINIMUM STC RATING INDICATED. SEE ALSO CODE PLANS, OTHER DRAWINGS AND PROJECT MANUAL FOR ADDITIONAL INFORMATION.
2. AT WALLS NOT REQUIRED TO BE FIRE RATED SEAL ALL NEW DUCT, PIPE AND MISCELLANEOUS PENETRATION THROUGH WALL WITH ACOUSTICAL MINERAL WOOL AND PROVIDE NON-COMBUSTIBLE SEALANT AT PERIMETER OF PENETRATION ON BOTH FACES OF WALL TO MAINTAIN STC RATING INDICATED.

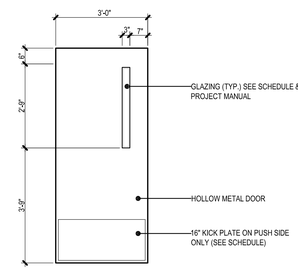
2 FRAME TYPES

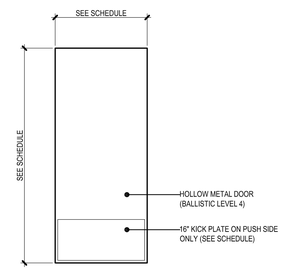
1/2"=1'-0"











1 DOOR TYPES

1/2"=1'-0"

DOOR SCHEDULE

DOOR										FRAME							FIRE				HARDWARE - SEE PROJECT MANUAL														REMARKS
	SIZE														DETAIL/SHEET NO.			RATING				FIRE CODE				DISABLED REQUIREMENTS								
DOOR NUMBER	SINGLE LEAF	DOUBLE LEAF	WIDTH	HEIGHT	TYPE - SEE 1HA80	DOOR MATERIAL	DOOR FINISH	GLAZING TYPE - SEE LEGEND		TYPE - SEE 2HA80	MATERIAL	WIDTH	HEIGHT, VIF	GLAZING	HEAD DETAIL (SEE 5HA80)	JAMB DETAIL (SEE 5HA80)	SADDLE TYPE (SEE 5HA80)	RESISTS PASS. OF SMOKE	90 MIN (LABELED)	60 MIN (LABELED)	45 MIN (LABELED)	NOT REQUIRED	PANIC DEVICE (LOCKABLE)	POSITIVE LATCHING	ELECTRONIC ACCESS	DELAYED ACTION CLOSER	HOLD OPENS - FIRE ALARM - SEE ELEC.	POWER OPERATOR	POWER ASSIST OPERATOR	LEVER HANDLES/LOCKABLE	PULL (EXTERIOR TRIM)	KICK PLATE	TACTILE WARNING	ACCESSIBLE THRESHOLD	SIGNAGE	SIGNAGE MOUNTING HEIGHT: 48" A.F.F.	
00A	○																										●								- INDICATES NEW WORK
01A		●	3'-0"	7'-0"	A	HM	PTD	GL-7		1	HM	6'-4"	11'-4"		C/D	A/M	N				●	●		●		●		●		●		●	S1, S2	STAIR/LOBBY, EXIT	○ - INDICATES EXISTING TO REMAIN
01B		●	3'-0"	7'-0"	A	HM	PTD	GL-7		1	HM	6'-4"	11'-4"		C/D	B	N				●	●				●		●		●		●			
01C		●	3'-0"	7'-0"	A	HM	PTD	GL-7		1	HM	6'-4"	11'-4"		C/D	A/M	N				●	●				●		●		●		●			
01D	●		3'-0"	7'-0"	C	HM	PTD			3	HM	3'-4"	7'-4"		K	J	N	●		●				●		●	●			●		●	S1	ELEVATOR	
02A		●	3'-0"	7'-0"	B	HM	PTD	GL-2		2	HM	6'-4"	11'-4"		G/H	E	N	●		●			●	●		●				●		●	S1, S2	LOBBY, EXIT	
02B		●	3'-0"	7'-0"	B	HM	PTD	GL-2		2	HM	6'-4"	11'-4"		G/H	F	N	●		●			●	●		●				●		●			
02C		●	3'-0"	7'-0"	B	HM	PTD	GL-2		2	HM	6'-4"	11'-4"		G/H	E	N	●		●			●	●		●				●		●			
20A	○																								●		●		●					

LEGEND:

AL	ALUMINUM	INSUL	INSULATED
ETR	EXISTING TO REMAIN	STL	STEEL
EXT	EXTERIOR	TEMP	TEMPERED
GL	GLAZING	WD	WOOD
HM	HOLLOW METAL		

GENERAL NOTES:

1. CONTRACTOR SHALL FIELD VERIFY ALL CONDITIONS & DIMENSIONS & NOTIFY ARCHITECT IMMEDIATELY OF ANY DISCREPANCIES.
2. COORDINATE w/ARCHITECT & OWNER FOR ANY & ALL SIGNAGE/NUMBERING.
3. COORDINATE w/PROJECT MANUAL FOR ADDITIONAL DOOR/HARDWARE INFORMATION.
4. COORDINATE ALL ELECTRONIC ACCESS CONTROLS & KEYING w/ARCHITECT & OWNER.
5. PROVIDE FULLY WELDED METAL DOOR FRAMES AT ALL NEW & EXISTING MASONRY WALL CONSTRUCTION.
6. PROVIDE HM DOORS AND FRAMES WITH PAINTED FINISH. COORDINATE w/OWNER & ARCHITECT.

GLAZING LEGEND:	
GL-2	CLEAR, TEMPERED
GL-7	CLEAR, BALLISTIC

Project Title:

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203 230 9007 silverpetrucelli.com

Revision:	Description:	Date:	Revised By:
	-	-	

Drawing Title:

DOOR SCHEDULE, TYPES & DETAILS

Project Phase:

ISSUED FOR BID

State Project Number:

N/A

Date: 11/10/2026

Scale: AS NOTED

Drawn By: MHM

Project Number: 24-179

Drawing Number:

A850

ABBREVIATIONS (NOT ALL ARE USED)

(###)	CFM
ABV	ABOVE
AC	AIR COMPRESSOR
AD	ACCESS DOOR
AF	AIRFOIL
AFF	ABOVE FINISHED FLOOR
AFMS	AIR FLOW MEASURING STATION
AHU#	AIR HANDLING UNIT
AL	ACOUSTIC LINING
ALD	AUTOMATIC LOUVER DAMPER
APD	AIR PRESSURE DROP
AUTO	AUTOMATIC
AWT	AVERAGE WATER TEMPERATURE
B-#	BOILER
BC	BACKWARD CURVED
BD	BELT DRIVE
BMCS	BUILDING MANAGEMENT & CONTROL SYSTEM
BTU	BRITISH THERMAL UNIT
CAP	CAPACITY
CB-#	CONTROL BOX
CC-#	COOLING COIL
CD	CONDENSATE DRAIN
CFM	CUBIC FEET PER MINUTE
CH-#	CHILLER
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
CLG	CEILING
CONV-#	HOT WATER CONVECTOR
CP	CONDENSATE RECEIVER/PUMPING SYSTEM
CWR	CONDENSER WATER RETURN
CWS	CONDENSER WATER SUPPLY
CT-#	COOLING TOWER
CUH-#	CABINET UNIT HEATER
CV	CONTROL VALVE
dB	DECIBELS
DB	DRY BULB
DDC	DIRECT DIGITAL CONTROL
DIA. or Ø	DIAMETER
DIFF	DIFFUSER
DL	DOOR LOUVER
DN	DOWN
DOAS	DEDICATED OUTDOOR AIR SYSTEM
DP	DEWPOINT TEMPERATURE
DR	DROP
DTR	DUAL TEMPERATURE WATER RETURN
DTS	DUAL TEMPERATURE WATER SUPPLY
DX	DIRECT EXPANSION
EAT	ENTERING AIR TEMPERATURE
ECM	ELECTRONICALLY COMMUTATED MOTOR
EER	ENERGY EFFICIENCY RATIO
EF-#	EXHAUST FAN
EG	EXHAUST GRILLE
EHC-#	ELECTRIC HEATING COIL
ER	EXHAUST REGISTER
ES	END SUCTION
ESP	EXTERNAL STATIC PRESSURE
ET-#	EXPANSION TANK
EUH-#	ELECTRIC UNIT HEATER
EWH-#	ELECTRIC WALL HEATER
EWT	ENTERING WATER TEMPERATURE
EWT	ENTERING WATER TEMPERATURE
EX	EXISTING
EXH	EXHAUST
EXT	EXTERNAL
F	DEGREES FAHRENHEIT
FA	FACE AREA
FAI	FRESH AIR INTAKE
F&B	FACE & BYPASS DAMPER
FBO	FURNISHED BY OTHERS (INSTALLED BY HVAC SUBCONTRACTOR)
FC	FORWARD CURVE
FCU	FAN COIL UNIT
FD/AD	FIRE DAMPER WITH ACCESS DOOR
FF	FINAL FILTER
FIBO	FURNISHED AND INSTALLED BY OTHERS
FIN FL	FINISH FLOOR
FL	FLOOR
FLA	FULL LOAD AMPERES
FLEX	FLEXIBLE
FPF	FINS PER FOOT
FS	FLOW SWITCH
FT	FEET
F.T.	FLOAT & THERMOSTATIC TRAP
FTR	FIN TUBE RADIATION
FV	FACE VELOCITY
GC	GENERAL CONTRACTOR
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GWLR	GEOTHERMAL WATER LOOP RETURN
GWLS	GEOTHERMAL WATER LOOP SUPPLY
H-#	HUMIDIFIER
H/C	HEATING/COOLING
HEPA	HIGH EFFICIENCY PARTICULATE ARRESTANCE
HC-#	HEATING COIL
HD	FEET OF HEAD
HGBP	HOT GAS BYPASS
HGRH	HOT GAS REHEAT
H-O-A	HAND-OFF-AUTOMATIC
HP-#	HEAT PUMP
HP	HORSEPOWER
HTG	HEATING
HV-#	HEATING AND VENTILATING UNIT
HVAC	HEATING, VENTILATING & AIR CONDITIONING
HX-#	HEAT EXCHANGER CONVERTOR
IBT	INVERTED BUCKET TRAP
ID	INSIDE DIMENSION
IL	INLINE
IN	INCHES
IV	INLET GUIDE VANES
KW	KILOWATT
KWH	KILOWATT HOUR
LAT	LEAVING AIR TEMPERATURE
LD	LINEAR DIFFUSER
LIN	LINEAR
LRA	LOCKED ROTOR AMPERES
LPR	LOW PRESSURE STREAM RETURN
LPS	LOW PRESSURE STEAM SUPPLY
LWT	LEAVING WATER TEMPERATURE
MAN	MANUAL
MAT	MIXED AIR TEMPERATURE
MAX	MAXIMUM
MBH	1000 BTU'S
MCA	MINIMUM CIRCUIT AMPACITY
MD	MOTORIZED DAMPER
MER	MECHANICAL EQUIPMENT ROOM
MERV	MINIMUM EFFICIENCY RESISTANCE VALUE
MEZZ	MEZZANINE
MFS	MAXIMUM FUSE SIZE
MIN	MINIMUM
MOCP	MINIMUM OVERCURRENT PROTECTION
MOT	MOTOR
MUA	MAKE-UP AIR
MV	MOTORIZED VALVE
NC	NOISE CRITERIA
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAI	OUTDOOR AIR INTAKE
OAT	OUTDOOR AIR TEMPERATURE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIMENSION
O.E. T.D.	OPEN END TRANSFER DUCT
P-#	PUMP
PB	PUSH BUTTON
PBD	PARALLEL BLADE DAMPER
PD	PRESSURE DROP
PF	PREFILTER
PH	PHASE
PHC	PREHEAT COIL
PRV	PRESSURE REDUCING VALVE
PSI	POUND PER SQUARE INCH
RA	RETURN AIR
RAF-#	RETURN AIR FAN
RAT	RETURN AIR TEMPERATURE
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RLA	RATED LOAD AMPS
RM	ROOM
RP	RADIANT PANEL
RPM	REVOLUTIONS PER MINUTE
RTU-#	ROOFTOP AIR CONDITIONING UNIT
SA	SUPPLY AIR
SAF-#	SUPPLY AIR FAN
SAT	SUPPLY AIR TEMPERATURE
SB	SECURITY BARS
SD	SMOKE DAMPER
SEER	SEASONAL ENERGY EFFICIENCY RATIO
SG	SUPPLY GRILLE
SP	STATIC PRESSURE
SQ FT	SQUARE FOOT (AREA)
ST	SINGLE POLE SWITCH W/ THERMAL OVERLOAD
SWR	SIDE WALL REGISTER
TD	TEMPERATURE DIFFERENCE
TDV	TRIPLE DUTY VALVE
TEMP	TEMPERATURE
TG	AIR TRANSFER GRILLE
TN-HR	TON HOUR REFRIGERATION
TOT	TOTAL
TRD	TRANSFER DUCT
T'STAT	THERMOSTAT
TT	THERMOSTATIC TRAP
TYP	TYPICAL
UC	UNDERCUT DOOR
UH-#	UNIT HEATER
UV-#	UNIT VENTILATOR
VAV-#	VARIABLE AIR VOLUME
VD	VOLUME DAMPER
VE	VOLUME EXTRACTOR
VFD	VARIABLE FREQUENCY DRIVE
VI	VIBRATION ISOLATOR
W/	WITH
WB	WET BULB
WFM	WATER FLOW MEASURING STATION
WMS	WIRE MESH SCREEN
WPD	WATER PRESSURE DROP
WSHP	WATER SOURCE HEAT PUMP
WT	WEIGHT (LBS)
ZD	ZONE DAMPER

SYMBOL LEGEND (NOT ALL SYMBOLS ARE USED)

	PRESSURE/TEMPERATURE PORT		PIPE UNION	(##)	MECHANICAL DEMOLITION NOTE, NUMBER INDICATES NOTE
T	TEMPERATURE GAUGE/ TEMPERATURE INDICATOR	AV	AIR VENT, AUTOMATIC	C##	MECHANICAL CONSTRUCTION NOTE, NUMBER INDICATED NOTE
	PRESSURE GAUGE		AIR VENT, MANUAL	VD	VOLUME DAMPER
	BUTTERFLY VALVE	OR	PUMP OR FAN	BD	BACKDRAFT DAMPER
	SHUT-OFF VALVE		STRAINER	SPS	DUCT STATIC PRESSURE SENSOR
	BALL VALVE		STRAINER, BLOW OFF	MD	MOTORIZED DAMPER
	GLOBE VALE	FS	FLOW SWITCH		SUPPLY OR OUTSIDE AIR DUCT OR DIFFUSER / REGISTER
	TWO WAY MOTORIZED CONTROL VALVE	T	SPACE TEMPERATURE SENSOR		SUPPLY OR OUTSIDE AIR DUCT DOWN
	THREE WAY MOTORIZED CONTROL VALVE	P	PRESSURE SENSOR		RETURN DUCT OR GRILLE
	CHECK VALVE		DIRECTION OF FLOW		RETURN DUCT DOWN
	HOSE END DRAIN	M	METER		EXHAUST AIR DUCT OR EXHAUST GRILLE
	OS & Y	DIA. OR Ø	DIAMETER		EXHAUST AIR DUCT DOWN
	SAFETY RELIEF VALVE (PRESS. & TEMP.)	OR	THERMOMETER		RETURN GRILLE
	DRAIN VALVE W/ HOSE COUPLING W/CAP		PIPE TEE, OUTLET UP	FC	FLEXIBLE CONNECTION
	CAP		PIPE TEE, OUTLET DOWN		RECTANGULAR TO ROUND TRANSITION
	PIPE CONNECTION BOTTOM		PIPE ELBOW, TURNED UP		TRANSITION
	PIPE CONNECTION TOP		PIPE ELBOW, TURNED DOWN		DUCT WORK, DIRECTION OF FLOW
	PIPE COUPLING (JOINT)	HWS	HOT WATER SUPPLY	R	CHANGE OF ELEVATION, RISE (R) DROP (D)
	ELBOW, 90°	HWR	HOT WATER RETURN		LINED DUCT WORK
	PIPE ELBOW, TURNED DOWN	CHWS	CHILLED WATER SUPPLY		DIRECTION OF SUPPLY OR OUTSIDE AIR
	PIPE TEE	CHWR	CHILLED WATER RETURN		DIRECTION OF RETURN OR EXHAUST AIR
	CALIBRATED BALANCING VALVE		POINT OF CONNECTION	S	SMOKE DETECTOR IN DUCT (FIBO)
H	HUMIDISTAT/ HUMIDITY SENSOR	SMD	SMOKE DAMPER	FD/AD	FIRE DAMPER W/ ACCESS DOOR
H	DUCT MOUNTED HUMIDITY SENSOR	FSD	COMBINATION FIRE AND SMOKE DAMPER		DUCT ACCESS DOOR
CO2	DUCT MOUNTED CARBON DIOXIDE SENSOR	CO	CARBON MONOXIDE SENSOR		
FM	FLOW METER	CO2	CARBON DIOXIDE SENSOR		
		NO2	NITROGEN DIOXIDE SENSOR		

PROJECT GENERAL NOTES

1. THE INTENT OF THESE CONTRACT DOCUMENTS IS FOR THE CONTRACTOR TO FURNISH AND INSTALL COMPLETE MECHANICAL AND ELECTRICAL SYSTEMS. THESE MECHANICAL AND ELECTRICAL SYSTEMS INCLUDE PLUMBING, FIRE PROTECTION, HVAC, ELECTRICAL AND ALL ASSOCIATED SPECIAL SYSTEMS. ALL SYSTEMS SHALL BE COORDINATED AND COMPLETE IN ALL RESPECTS. OPERATING, TESTED, ADJUSTED, APPROVED BY THE AUTHORITIES HAVING JURISDICTION AND READY FOR BENEFICIAL USE TO THE OWNER'S SATISFACTION.
2. THE CONTRACTOR SHALL OBTAIN AND REVIEW ALL CONTRACT DOCUMENTS, INCLUDING PROJECT MANUAL, PLANS AND SPECIFICATIONS OF ALL TRADES BEFORE SUBMITTING BID. REFER TO SPECIFICATIONS, PROJECT MANUAL AND PLANS, INCLUDING ALL EQUIPMENT SCHEDULES FOR MECHANICAL AND ELECTRICAL INFORMATION. CONTRACTOR SHALL WALK THROUGH BUILDING TO BECOME FULLY FAMILIAR WITH IT PRIOR TO SUBMITTING BID.
3. ALL OF THE CONTRACT DRAWINGS AND SPECIFICATIONS ARE COMPLEMENTARY TO FORM A TOTAL DESIGN PACKAGE. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR/CONSTRUCTION MANAGER TO DETERMINE WHICH TRADE CONTRACTOR IS RESPONSIBLE FOR VARIOUS PORTIONS OF THE WORK.
4. ALL WORK AND ACTION DEPICTED AND DESCRIBED SHALL BE PERFORMED BY THE CONTRACTOR UNLESS SPECIFICALLY NOTED OTHERWISE.
5. PROVIDE SUPPORT/BRACING OF EQUIPMENT AND BUILDING SERVICES FOR SEISMIC RESTRAINT AS REQUIRED BY CODE.
6. OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND INSPECTIONS.
7. ALL EQUIPMENT, MATERIALS AND RELATED SYSTEM COMPONENTS SHALL BE NEW UNLESS SPECIFICALLY NOTED OTHERWISE.
8. REPAIR AND/OR REPLACE AT NO COST TO OWNER ALL EQUIPMENT AND MATERIALS DAMAGED DURING CONSTRUCTION.
9. THE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS AND WORK INCLUDED IN THE CONTRACT. THE CONTRACTOR SHALL COORDINATE LOCATIONS OF EQUIPMENT WITH ALL TRADES BEFORE STARTING CONSTRUCTION. ANY MODIFICATIONS TO THE EQUIPMENT LAYOUT REQUIRED FOR INSTALLATION ARE TO BE PERFORMED AT NO ADDITIONAL COST TO THE OWNER.
10. REFER TO THE ARCHITECTURAL DRAWINGS FOR THE EXACT LOCATION OF LIGHT FIXTURES AND MOUNTING HEIGHTS OF EQUIPMENT. INCLUSIVE OF RECEPTACLES, SWITCHES, THERMOSTATS, ETC. ALL SUCH EQUIPMENT AND COLORS SHALL BE COORDINATED WITH THE ARCHITECT. CONTACT ARCHITECT FOR CLARIFICATION OF MOUNTING REQUIREMENTS, IF INFORMATION IS NOT CONTAINED IN THE DRAWINGS.
11. ALL WORK SHALL BE PERFORMED IN COMPLIANCE WITH THE APPLICABLE CODES, ORDINANCES AND THE REGULATORY AGENCIES HAVING JURISDICTION.
12. ALL EQUIPMENT, DAMPERS, VALVES, SMOKE DETECTORS, FIRE DAMPERS SHALL BE LOCATED IN ACCESSIBLE LOCATIONS. WHEN EQUIPMENT, DAMPERS, VALVES, SMOKE DETECTORS, FIRE DAMPERS MUST BE LOCATED ABOVE AN INACCESSIBLE CEILING OR WALL THEN AN APPROPRIATE ACCESS DOOR / PANEL SHALL BE PROVIDED. THESE SHALL BE COORDINATED WITH THE ARCHITECT AND SUITABLE FOR THE ASSEMBLY RATING BEING PENETRATED.
13. WHEN CONFLICTS OCCUR BETWEEN THE DRAWINGS AND/OR SPECIFICATIONS IT SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER. THE CONTRACTOR SHALL CARRY AS PART OF THE BID THE LARGER QUANTITY AND/OR MORE EXPENSIVE ITEM(S).
14. CONTRACTORS SHALL COORDINATE THEIR WORK WITH ALL OWNER-FURNISHED EQUIPMENT, INCLUDING REQUIRED SERVICE CONNECTIONS, RECEPTACLES, ETC. BEFORE INSTALLATION.
15. CONTRACTORS SHALL PROVIDE ALL REQUIRED SLEEVES AND SEALS FOR PIPES OR CONDUIT PENETRATING WALLS OR SLABS WITH FIRE STOPPING SEALANT WHERE REQUIRED.
16. ELECTRICAL CONDUITS & BOXES TO BE CONCEALED IN WALLS OR ABOVE CEILING WHEREVER POSSIBLE.
17. COORDINATE ALL PIPING AND CONDUITS LEAVING THE BUILDING WITH THE SITE CONTRACTOR(S) BEFORE INSTALLATION.
18. PROVIDE VIBRATION ISOLATION FOR ALL MECHANICAL EQUIPMENT.
19. PROVIDE VIBRATION ISOLATORS FOR ALL PIPING SUPPORTS CONNECTED TO AND WITHIN 50 FEET OF ISOLATED EQUIPMENT THROUGHOUT MECHANICAL EQUIPMENT ROOMS.
20. LOCATE ALL TEMPERATURE, PRESSURE AND FLOW MEASURING DEVICES IN VISIBLE AND ACCESSIBLE LOCATIONS WITH STRAIGHT SECTION OF PIPE OR DUCT UP/DOWN STREAM AS RECOMMENDED BY THE MANUFACTURER FOR GOOD ACCURACY.
21. ALL EQUIPMENT, PIPING, AND DUCT WORK SHALL BE SUPPORTED AS DETAILED, SPECIFIED AND REQUIRED TO PROVIDE A VIBRATION FREE INSTALLATION.
22. LOCATION AND SIZES OF ALL FLOOR, WALL AND ROOF PENETRATIONS SHALL BE COORDINATED WITH ALL OTHER TRADES INVOLVED.
23. INSTALL COMPLETE OPERATING SYSTEMS. PROVIDE ALL COMPONENTS, DEVICES, CONTROLS, RELAYS, TRANSFORMERS, ETC., WHETHER INDICATED OR NOT, FOR COMPLETE SYSTEMS AS INTENDED BY THE CONSTRUCTION DOCUMENTS.
24. ALL NEW EQUIPMENT SPECIFIED IN THE SCHEDULES SHALL BE CONNECTED TO THE BMCS.
25. SOME PART OF THE BUILDING WILL BE OCCUPIED DURING CONSTRUCTION. REFER TO PHASING PLAN FOR MORE INFORMATION. MAINTAIN EXISTING SERVICES TO OCCUPIED AREAS. SEAL ALL DUCTWORK AND VENTILATION OPENINGS COMMUNICATING CONSTRUCTION AREAS WITH OCCUPIED AREAS TO PREVENT THE TRANSFER OF AIR CONTAMINATED BY CONSTRUCTION ACTIVITIES.
26. ALL PENETRATIONS THRU RATED WALLS, FLOORS & CEILINGS SHALL BE SEALED USING U.L. LISTED METHODS APPROPRIATE FOR INDICATED RATING.

MECHANICAL DRAWING LIST

M001	MECH ABBREVIATIONS, NOTES & SYMBOLS
M100	MECHANICAL FLOOR PLAN
M300	MECH DETAILS

HVAC NOTES

1. PIPING AND DUCT WORK LAYOUTS AS INDICATED ON THE DRAWINGS ARE DIAGRAMMATIC; PROVIDE ADDITIONAL TRANSITIONS AND OFFSETS AS REQUIRED FOR COORDINATION WITH BUILDING CONSTRUCTION AND THE WORK OF OTHER TRADES AT NO ADDITIONAL COST TO THE OWNER.
2. PROVIDE VOLUME DAMPERS, THROTTLING VALVES AND ISOLATION VALVES AS SPECIFIED AND/OR AS INDICATED ON THE DRAWINGS.
3. THE ABUILDING MANAGEMENT AND CONTROL SYSTEM SHALL BE COMPLETE IN ALL REGARDS, TESTED AND CAPABLE OF ACHIEVING THE SEQUENCES OF OPERATION. ALL DEVICES SHALL BE UNDER SYSTEM CONTROL. ALL ZONES SHALL BE THERMOSTATICALLY CONTROLLED WHETHER OR NOT A THERMOSTAT, SENSOR OR CONTROLLER IS INDICATED.
4. MAINTAIN MANUFACTURER'S RECOMMENDED MINIMUM CLEARANCES FOR INSTALLATION OF EQUIPMENT.
5. PROVIDE VANDAL RESISTANT COVERS ON THERMOSTATS, AS NOTED.

ADDITION AND RENOVATION NOTES

1. THIS PROJECT IS AN EXISTING FACILITY ADDITION AND RENOVATION.
2. BEFORE SUBMITTING BIDS, THE CONTRACTOR SHALL VISIT THE SITE AND BECOME THOROUGHLY FAMILIAR WITH THE EXISTING CONDITIONS UNDER WHICH THE PROJECT IS TO BE COMPLETED.
3. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY ASSUMPTIONS, OMISSIONS OR ERRORS MADE AS A RESULT ON OF THEIR FAILURE TO BECOME FULLY FAMILIAR WITH THE EXISTING CONDITIONS.
4. IT IS NOT THE INTENT OF THESE DRAWINGS TO SHOW EVERY PIECE OF EQUIPMENT, PIPING OR CONDUIT TO BE REMOVED. EQUIPMENT NOT BEING USED SHALL BE REMOVED INCLUDING ALL ASSOCIATED HANGERS, SUPPORTS, PIPES, DUCTS, CONDUITS, WIRES AND CONTROLS BACK TO THE POINT OF ORIGIN.
5. NO EQUIPMENT, PIPING OR CONDUIT SHALL BE ABANDONED IN PLACE UNLESS SPECIFICALLY NOTED.
6. PROPERLY DISPOSE OF ALL DEMOLISHED EQUIPMENT AND MATERIALS IN COMPLIANCE WITH CODES AND REGULATIONS.
7. RELOCATE EXISTING EQUIPMENT, PIPING, WIRING AND RELATED SYSTEMS TO REMAIN AS REQUIRED FOR CONSTRUCTION. EXTEND FEEDER/CONDUIT AND PROVIDE RECONNECTIONS FOR SYSTEM TO BE FULLY OPERATIONAL. ALL RELOCATED EQUIPMENT SHALL BE PROTECTED DURING CONSTRUCTION.
8. PROVIDE TEMPORARY CONNECTIONS AND SYSTEM MODIFICATIONS AS REQUIRED FOR PHASED CONSTRUCTION.
9. GENERAL CONTRACTOR IS RESPONSIBLE FOR PATCHING, REPAIRING, CAPPING, ETC. PER DEMOLITION AND CONSTRUCTION REQUIREMENTS.
10. CONTRACTOR SHALL PERFORM ALL WORK IN ACCORDANCE WITH THE IAQ REQUIREMENTS INDICATED IN SPECIFICATION 018113, SECTION 3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT.

PIPING NOTES

1. UNLESS OTHERWISE NOTED, ALL PIPING IS OVERHEAD, TIGHT TO UNDERSIDE OF STRUCTURE OR SLAB, WITH SPACE FOR INSULATION.
2. INSTALL PIPING SO THAT ALL VALVES, STRAINERS, UNIONS, TRAPS, FLANGES AND OTHER APPURTENANCES REQUIRING ACCESS ARE ACCESSIBLE.
3. UNIONS AND/OR FLANGES SHALL BE INSTALLED AT EACH PIECE OF EQUIPMENT, IN BYPASSES AND IN LONG PIPING RUNS (100 FEET OR MORE) TO PERMIT DISASSEMBLY FOR ALTERATION AND REPAIRS.
4. ALL PIPING WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. OFFSETS IN PIPING AROUND OBSTRUCTIONS SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
5. PROVIDE FLEXIBLE CONNECTIONS IN ALL PIPING SYSTEMS CONNECTED TO PUMPS AND OTHER EQUIPMENT WHICH REQUIRE VIBRATION ISOLATION, EXCEPT WATER COILS. FLEXIBLE CONNECTIONS SHALL BE PROVIDED AS CLOSE TO THE EQUIPMENT AS POSSIBLE.
6. ALL PENETRATIONS THRU RATED WALLS, FLOORS & CEILINGS SHALL BE SEALED USING U.L. LISTED METHODS APPROPRIATE FOR INDICATED ASSEMBLY RATING.
7. PROVIDE SWING JOINTS AT ALL BRANCH CONNECTIONS TO WATER SUPPLY AND RETURN. PROVIDE ISOLATION VALVES AT ALL BRANCH CONNECTIONS.
8. PROVIDE AIR VENTS AT ALL HIGH POINTS.
9. INSTALL DRAIN VALVES WITH HOSE CONNECTION AT ALL LOW POINTS.
10. PROVIDE HOSE END CAPS WITH CHAIN ON ALL DRAIN VALVES.
11. ALL PIPING PASSING THROUGH BUILDING EXPANSION JOINTS SHALL BE PROVIDED WITH PIPING EXPANSION LOOPS.
12. ALL PIPING, VALVES AND FITTINGS SHALL BE PROVIDED WITH INSULATION FOR SERVICES REQUIRING INSULATION.
13. ALL EXISTING PIPING AND ASSOCIATED FITTINGS THAT ARE TO REMAIN TEMPORARILY AS PART OF THE CONSTRUCTION MANAGER'S STAGING PLAN AND THAT ARE AFFECTED BY ABATEMENT WORK SHALL BE PROVIDED WITH NEW INSULATION. REFER TO ABATEMENT DRAWINGS AND PROJECT MANUAL.

Project Title:

GREENWICH PUBLIC SCHOOLS - EASTERN MIDDLE SCHOOL SECURE ENTRANCE

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RIVERSIDE, CT 06878

SILVER PETRUCELLI + ASSOCIATES

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Revision:	Description:	Date:	Revised By:
	-	-	

Drawing Title:
MECHANICAL ABBREVIATIONS, NOTES & SYMBOLS

Project Phase:
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State Project Number:
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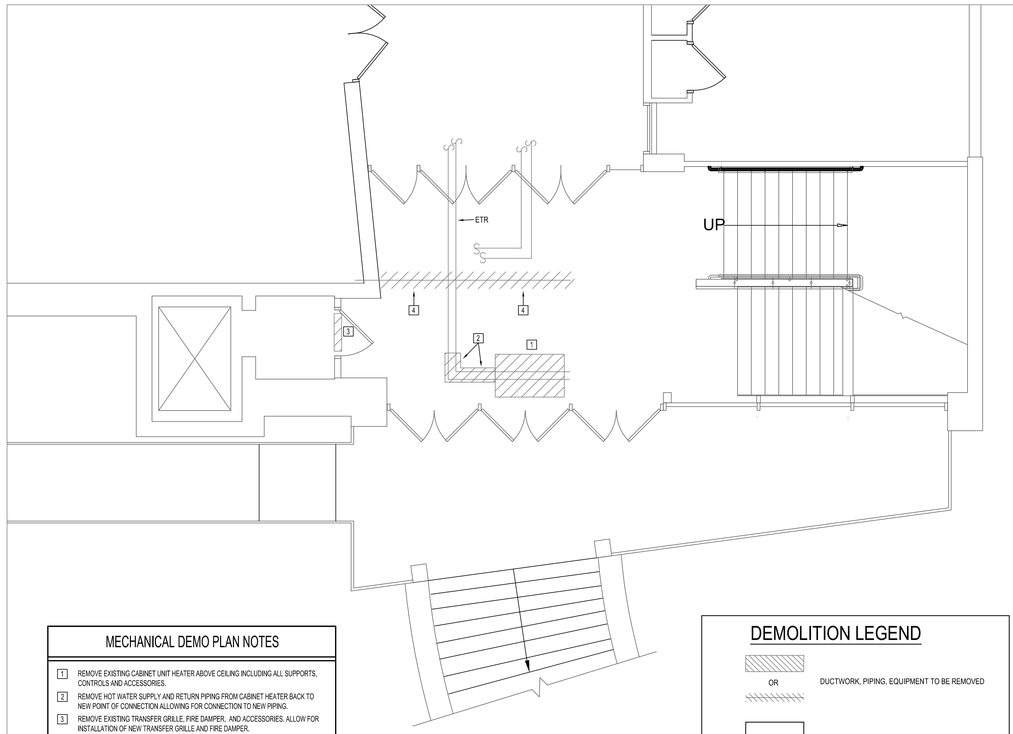
Date: 11/10/2026

Scale: AS NOTED

Drawn By: N. FAWCETT, J. PECKINGHAM

Project Number: 24-179

Drawing Number: M001



MECHANICAL DEMO PLAN NOTES

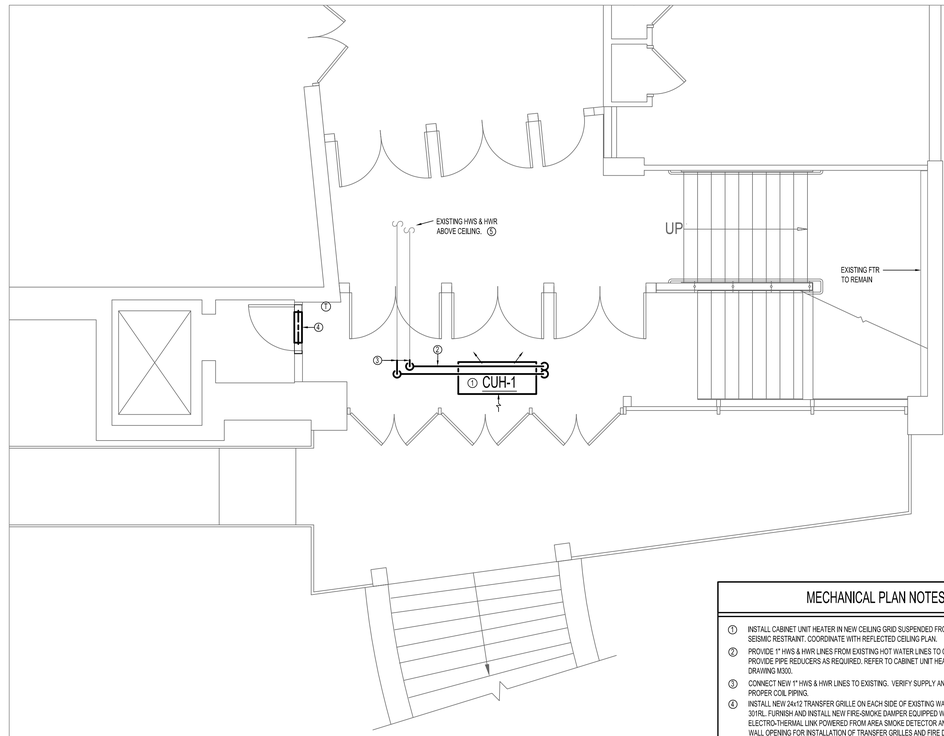
1. REMOVE EXISTING CABINET UNIT HEATER ABOVE CEILING INCLUDING ALL SUPPORTS, CONTROLS AND ACCESSORIES.
2. REMOVE HOT WATER SUPPLY AND RETURN PIPING FROM CABINET HEATER BACK TO NEW POINT OF CONNECTION ALLOWING FOR CONNECTION TO NEW PIPING.
3. REMOVE EXISTING TRANSFER GRILLE, FIRE DAMPER, AND ACCESSORIES. ALLOW FOR INSTALLATION OF NEW TRANSFER GRILLE AND FIRE DAMPER.
4. REMOVE EXISTING ABANDONED PIPE ABOVE CEILING.

DEMOLITION LEGEND

OR	DUCTWORK, PIPING, EQUIPMENT TO BE REMOVED
OR	DUCTWORK, PIPING, EQUIPMENT TO REMAIN
ETR	EXISTING TO REMAIN

MECHANICAL PARTIAL DEMO PLAN

SCALE: 1/4"=1'-0"



MECHANICAL PLAN NOTES

1. INSTALL CABINET UNIT HEATER IN NEW CEILING GRID SUSPENDED FROM STRUCTURE. PROVIDE SEISMIC RESTRAINT. COORDINATE WITH REFLECTED CEILING PLAN.
2. PROVIDE 1" HWS & HWR LINES FROM EXISTING HOT WATER LINES TO COIL CONNECTIONS. PROVIDE PIPE REDUCERS AS REQUIRED. REFER TO CABINET UNIT HEATER PIPING DIAGRAM, DRAWING M300.
3. CONNECT NEW 1" HWS & HWR LINES TO EXISTING. VERIFY SUPPLY AND RETURN LINES FOR PROPER COIL PIPING.
4. INSTALL NEW 24x12 TRANSFER GRILLE ON EACH SIDE OF EXISTING WALL OPENING, TITUS MODEL 301RL. FURNISH AND INSTALL NEW FIRE-SMOKE DAMPER EQUIPPED WITH NAILOR ELECTRO-THERMAL LINK POWERED FROM AREA SMOKE DETECTOR AND FACP. PROVIDE FRAMED WALL OPENING FOR INSTALLATION OF TRANSFER GRILLES AND FIRE DAMPER. INSTALL GRILLE TO ALLOW SERVICE ACCESS TO FIRE-SMOKE DAMPER. REFER TO DETAIL, DRAWING M300.
5. INSULATE 1" HWS & HWR LINES BACK TO MAIN.

MECHANICAL PARTIAL FLOOR PLAN

SCALE: 1/4"=1'-0"

CABINET UNIT HEATER SCHEDULE

SYMBOL	CFM AT HIGH SPEED	SP (IN WG)	MOTORS QTY x HP	ELECTRICAL VOLTS/Ø	ELECTRICAL AMPS	HEATING CAPACITY (MBH)	EAT (°F)	EWT (°F)	GPM	ΔT_W (°F)	MAX ΔP_W (FT.HD.)	DIMENSIONS L x H x D (INCHES)	TYPE	MANUFACTURER & MODEL NO.	NOTES
CUH-1	860	0	2 x 1/10	115/1	2.2	55	60	200	6	18.6	2.5	61 x 25 x 9.5	CEILING RECESSED	STERLING RC-1200-08	

NOTES:
1. FURNISH SERVICE DISCONNECT, WALL MOUNTED THERMOSTAT, AQUASTAT, DISCONNECT SWITCH, AND 3-SPEED CONTROL.
2. FURNISH MOTOR WITH INTERNAL THERMAL OVERLOAD PROTECTION.
3. FURNISH WITH HINGED BOTTOM PANEL, WASHABLE FILTER, AND BOTTOM STAMPED SUPPLY AND RETURN GRILLES.

Project Title:

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Drawing Title: MECHANICAL PARTIAL FLOOR PLAN

Project Phase: ISSUED FOR BID

State Project Number: N/A

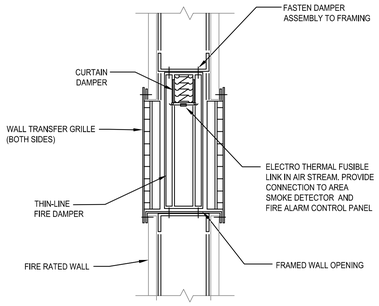
Date: 11/10/2026

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Drawn By: N. FAWCETT, J. PECKINGHAM

Project Number: 24-179

Drawing Number: M100

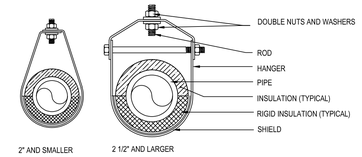


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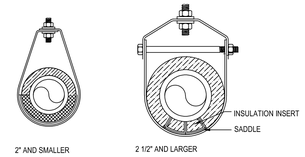
1. INSTALL GRILLES WITH REMOVABLE FASTENERS FOR ACCESS TO DAMPER.
2. INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS AND NFPA-90A.
3. REFER TO SMACNA-"FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC SYSTEMS" FOR FIRE DAMPER INSTALLATION DETAILS.
4. PROVIDE MINIMUM 16 GA. STEEL FRAMING FOR WALL OPENING.

TRANSFER GRILLE / FIRE-SMOKE DAMPER DETAIL

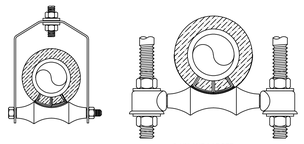
SCALE: NONE



FLUIDS LESS THAN 100°F



FLUIDS GREATER THAN 100°F

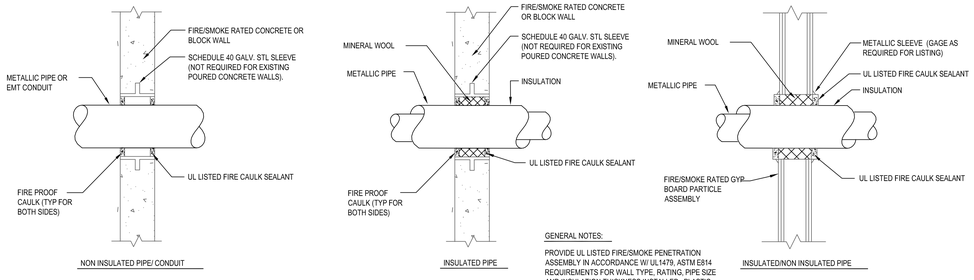


FLUIDS 150°F-250°F 50' FROM ANCHOR
FLUIDS GREATER THAN 250°F 30' FROM ANCHOR

HANGER SCHEDULE		
PIPE SIZE	ROD SIZE	MAX. SPACING
UP TO 1 1/4"	3/8" DIA.	8' STEEL
UP TO 1 1/4"	3/8" DIA.	6' COPPER & BRASS
1 1/2" & 2"	3/8" DIA.	10'
2 1/2" & 3"	1/2" DIA.	10'
4" & 5"	5/8" DIA.	10'
6"	3/4" DIA.	10'
8", 10", 12"	7/8" DIA.	10'
14" & 16"	1" DIA.	10'
18"	1 1/8" DIA.	10'
20" & 24"	1 1/4" DIA.	10'

1 PIPE HANGER DETAIL

NOT TO SCALE

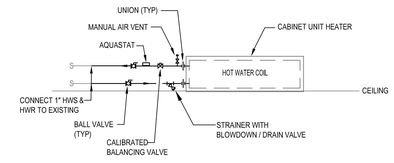


GENERAL NOTES:

PROVIDE UL LISTED FIRE/SMOKE PENETRATION ASSEMBLY IN ACCORDANCE W/ UL1479, ASTM E814 REQUIREMENTS FOR WALL TYPE, RATING, PIPE SIZE AND INSULATION THICKNESS INSTALLED. PLASTIC PIPE SYSTEMS: REFER TO MANUFACTURERS REQUIREMENTS.

3 PIPE PENETRATION WITH FIRE / SMOKE SEAL

NOT TO SCALE



NOTES:

1. ALL REQUIRED CONTROLLERS AND SENSORS SHALL BE PROVIDED BY ATC CONTRACTOR. REFER TO 230900.

4 CABINET UNIT HEATER PIPING DETAIL

NOT TO SCALE

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Date: 11/10/2026

Scale: AS NOTED

Drawn By: N. FAWCETT, J. PECKINGHAM

Project Number: 24-179

Drawing Number: M300

PROJECT GENERAL NOTES (NOT ALL APPLY TO EVERY PROJECT)

GENERAL

1. WHEN A CONFLICT BETWEEN THE DRAWINGS, NOTES AND/OR SPECIFICATIONS OCCUR, THE MORE STRINGENT, AND/OR LARGER QUANTITY AND/OR MORE EXPENSIVE SHALL APPLY. THE REQUIREMENTS LISTED WITHIN NOTES OR SPECIFICATIONS SHALL BE REQUIRED, PROVIDED AND INSTALLED WHETHER SPECIFICALLY INDICATED ON THE DRAWINGS OR NOT.
2. ALL WORK AND ACTION DEPICTED AND DESCRIBED SHALL BE PERFORMED BY THE CONTRACTOR UNLESS SPECIFICALLY NOTED OTHERWISE.
3. REPAIR AND/OR REPLACE AT NO COST TO THE OWNER ALL EQUIPMENT, DEVICES AND MATERIALS DAMAGED DURING CONSTRUCTION.
4. ALL EQUIPMENT SHALL BE LOCATED IN ACCESSIBLE LOCATIONS. WHEN A PIECE OF EQUIPMENT MUST BE LOCATED ABOVE AN INACCESSIBLE CEILING OR WALL, THEN AN APPROPRIATE ACCESS DOOR SHALL BE PROVIDED. THESE SHALL BE COORDINATED WITH THE OWNER AND ARCHITECT.
5. ANY CHANGE ORDER PROPOSAL REQUEST FOR ELECTRICAL WORK AFTER AWARD MUST BE BASED ON NORMAL NECA COMMERCIAL LABOR UNITS & NATIONAL AVERAGE MATERIAL AMP MATERIAL COST PRICES; NATIONAL AVERAGE AMP DATA BASE FOR MATERIAL AND NECA LABOR RATES MUST BE SUBMITTED TO THE ENGINEER OF RECORD AT THE TIME OF AWARD.

WIRING & RACEWAY

1. THE DRAWINGS SHOW THE GENERAL LAYOUT AND TYPICAL DETAILS, PROVIDE ALL NECESSARY EQUIPMENT AND LABOR FOR A COMPLETE SYSTEM. DRAWINGS ARE BASED ON THE SPECIFIED EQUIPMENT, RACEWAY LAYOUTS, BOXES AND WIRING OF THE SYSTEMS ARE SUBJECT TO APPROVED SHOP DRAWINGS.
2. ENSURE THAT ITEMS TO BE FURNISHED FIT THE SPACE AVAILABLE. MAKE NECESSARY FIELD MEASUREMENTS TO ASCERTAIN SPACE REQUIREMENTS, INCLUDING THOSE FOR CONNECTIONS, AND PROVIDE SUCH SIZES AND SHAPES OF EQUIPMENT THAT FINAL INSTALLATION SHALL SATISFY THE INTENT OF THE DRAWINGS AND SPECIFICATIONS.
3. LOCATIONS OF OUTLETS, SWITCHES, APPLIANCES, ETC. AS SHOWN ON ELECTRICAL PLANS ARE APPROXIMATE; COORDINATE WITH ARCHITECTURAL AND MECHANICAL PLANS AND DETAILS, AND PROJECT CONDITIONS. INSTALL SWITCHES WITH "OFF" POSITION DOWN. INSTALL RECEPTACLES WITH GROUNDING POLE IN THE UP POSITION FOR VERTICAL MOUNTING AND AT RIGHT FOR HORIZONTAL MOUNTING.
4. LOCATE AND INSTALL ELECTRICAL EQUIPMENT, JUNCTION AND PULL BOXES, PANELBOARDS, SWITCHES, CONTROLS, AND OTHER APPARATUS REQUIRING MAINTENACE, INSPECTION, AND OPERATION SO AS TO BE READILY ACCESSIBLE.

RACEWAY INSTALLATION

1. IN ALL ARCHITECTURALLY FINISHED SPACES, CONDUITS AND CABLES SHALL BE RUN CONCEALED IN HUNG OR FURRED CEILINGS, SLABS, MASONRY, AND PARTITIONS UNLESS OTHERWISE INDICATED. SAW CUTTING AND FINISHED PATCHING SHALL BE REQUIRED IN EXISTING SLABS AND MASONRY WALLS. IN UNFINISHED SPACES, RACEWAYS MAY BE RUN EXPOSED.
2. UNLESS OTHERWISE INDICATED, EXACT ROUTING OF RACEWAYS SHALL BE DETERMINED BY THE CONTRACTOR TO SUIT PROJECT REQUIREMENTS AND FIELD CONDITIONS.
3. PROVIDE SEPARATE RACEWAYS, JUNCTION BOXES, PULL BOXES AND WIREWAYS FOR ALL EMERGENCY SYSTEM WIRING.
4. CONTRACTOR SHALL PROVIDE ALL REQUIRED SLEEVES AND SEALS FOR PIPES OR CONDUITS PENETRATING WALLS OR FLOOR SLABS WITH UL LISTED FIRE STOPPING SEALANT MATCHING OR EXCEEDING THE FLOOR OR WALL RATING WHERE REQUIRED.
5. ELECTRICAL CONDUITS AND BOXES SHALL BE CONCEALED IN WALLS OR ABOVE CEILINGS WHEREVER POSSIBLE. WHERE SURFACE CONDUIT(S) ARE REQUIRED IT MUST MATCH THE WALL COLOR (PAINTED) THAT IT IS BEING ATTACHED TO; REFER TO RACEWAY & BOX SPECIFICATION FOR FURTHER DETAILS.

WIRING INSTALLATION

1. DO NOT USE WIRE SMALLER THAN NO. 12 AWG FOR ANY POWER OR LIGHTING CIRCUIT. USE LARGER SIZES WHERE INDICATED, AS REQUIRED BY CODES, AND AS FOLLOWS:

   30 AMPERE CIRCUIT: NO. 10
   40 AMPERE CIRCUIT: NO. 8
   50 AMPERE CIRCUIT: NO. 6
   60 AMPERE CIRCUIT: NO. 6

A. MINIMUM HOMERUN AND BRANCH CIRCUIT WIRING SIZES AND MAXIMUM HOMERUN CONDUIT FILL FOR 120 VOLT, 20 AMPERE CIRCUITS SHALL BE AS FOLLOWS:

LENGTH	*CIRCUIT* WIRE SIZE	*HOME RUN* WIRE SIZE	*CONDUIT SIZE* (8 WIRES/CONDUIT)
0' - 50'	#12	#12	3/4"
51' - 100'	#12	#10	3/4"
101' - 200'	#10	#8	1"

GREATER THAN 200' - REQUEST DIRECTION FROM ARCHITECT.

NOTE: PROVIDE DERATING PER CODE WHEN INSTALLING MORE THAN 3 CURRENT CARRYING CONDUCTORS IN A SINGLE CONDUIT.

B. MINIMUM HOMERUN AND BRANCH CIRCUIT WIRING SIZES AND MAXIMUM HOMERUN CONDUIT FILL FOR 277 VOLT, 20 AMPERE CIRCUITS SHALL BE AS FOLLOWS:

LENGTH	*CIRCUIT* WIRE SIZE	*HOME RUN* WIRE SIZE	*CONDUIT SIZE* (8 WIRES/CONDUIT)
0' - 100'	#12	#12	3/4"
101' - 200'	#12	#10	3/4"

GREATER THAN 200' - REQUEST DIRECTION FROM ARCHITECT.

NOTE: PROVIDE DERATING PER CODE WHEN INSTALLING MORE THAN 3 CURRENT CARRYING CONDUCTORS IN A SINGLE CONDUIT.

2. DO NOT USE WIRE SMALLER THAN N0. 14 AWG FOR CONTROL CIRCUITS UNLESS OTHERWISE RECOMMENDED BY THE EQUIPMENT OR SYSTEMS MANUFACTURER ON WIRING SHOP DRAWINGS, AND SO APPROVED BY THE ENGINEER.
3. WHERE GREATER THAN THREE (3) CURRENT CARRYING CONDUCTORS ARE INSTALLED IN ANY ONE CONDUIT OR CABLE, CONDUCTORS MUST BE DERATED AND SIZES INCREASED, IF NEEDED, TO ACCOMMODATE CONDUCTORS DERATING AS REQUIRED BY NEC ARTICLE 310.
4. CONDUCTORS SHALL BE COMPLETELY INSTALLED AND CONNECTED. PROVIDE ALL TERMINALS, LUGS, AND CONNECTORS TO SUIT THE APPLICATION, AND IN COMPLIANCE WITH EQUIPMENT MANUFACTURERS' RECOMMENDATIONS.
5. UNDER NO CIRCUMSTANCES SHALL ANY SWITCH OR CIRCUIT BREAKER BREAK A NEUTRAL CONDUCTOR.
6. THE CIRCUIT NUMBERS INDICATED ON THE DRAWINGS ARE INTENDED AS A GUIDE FOR PROPER CONNECTION OF CIRCUITS AT PANELS. HOWEVER, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE FINAL CIRCUITING WORK FULFILLS THE FOLLOWING CONDITIONS:

A. LOADS ON PANEL BUSSES SHALL BE PHASE BALANCED AS EVENLY AS POSSIBLE.

GROUNDING INSTALLATION

1. EQUIPMENT GROUNDING

A. INSTALL AN INSULATED GROUND CONDUCTOR, RUN IN THE RACEWAY WITH THE PHASE CONDUCTORS, FOR EACH FEEDER SERVING: PANELBOARDS, LIGHTING DIMMER PANELS, MOTOR CONTROL CENTERS, MOTORS, EQUIPMENT AND APPLIANCES UNLESS OTHERWISE NOTED.

B. INCLUDE AN INSULATED GROUND CONDUCTOR IN ALL CONDUIT RUNS CONTAINING SECTIONS OF FLEXIBLE CONDUIT UNLESS OTHERWISE NOTED.

C. INCLUDE AN INSULATED GROUND CONDUCTOR IN ALL BRANCH CIRCUIT RACEWAYS OR CABLES UNLESS OTHERWISE NOTED.

2. TELECOMMUNICATIONS CLOSET GROUNDING

A. PROVIDE A #4 AWG GROUND CONDUCTOR RISER IN 1" EMT CONDUIT TO EACH TELECOMMUNICATIONS CLOSET GROUNDING BUSSBAR (TGB) FROM THE TELECOMMUNICATIONS MAIN GROUNDING BUSSBAR (TMGB), AND TO MAIN SERVICE GROUNDING ELECTRODE SYSTEM.

B. CONNECT THE GROUND RISER TO THE "TMGB" AND "TGB's" PER TIA/EIA STANDARDS 607.

C. PROVIDE ADDITIONAL #4 AWG GROUND CABLE CONNECTIONS FROM EACH "TMGB" AND "TGB" TO THE CLOSEST BUILDING STEEL AND TO THE GROUND BUS IN THE ELECTRIC PANEL FEEDING OUTLETS AND EQUIPMENT IN THE ASSOCIATED TELECOMMUNICATIONS ROOM/CLOSET.

3. GROUND EACH TELECOMMUNICATIONS, FIRE ALARM, SECURITY, AND BMS SYSTEM EQUIPMENT AND CONTROL PANEL WITHIN EACH TELECOMMUNICATIONS ROOM/CLOSET TO THE ASSOCIATED CLOSET "TMGB" OR "TGB" WITH #4 AWG CONDUCTOR PER TIA/EIA STANDARD 607.

RACEWAYS FOR TELECOMMUNICATION SYSTEMS

1. PROVIDE EMPTY CONDUIT SYSTEMS FOR TELECOMMUNICATION WORK, COMPLETE WITH PULL BOXES, OUTLET BOXES, AND CONDUIT AS INDICATED ON THE DRAWINGS.
2. PROVIDE MINIMUM INSIDE BENDING RADIUS OF 10 TIMES CONDUIT INSIDE DIAMETER FOR ALL TELECOMMUNICATIONS RACEWAYS.
3. WHEN COMPLETED THE CONDUIT SYSTEMS SHALL BE READY FOR INSTALLATION OF WIRING AND EQUIPMENT.
4. FOR EACH OUTLET PROVIDE A 1" EMPTY EMT CONDUIT ROUTED INTO THE CEILING CAVITY OR TO THE CLOSEST TELECOMMUNICATIONS CLOSET. PROVIDE A PULL STRING IN EACH CONDUIT RUN AND TERMINATE BEYOUND THE BUSHED ELBOW.

ELEVATOR EQUIPMENT WIRING

1. WORK INCLUDED

A. ELEVATOR EQUIPMENT WIRING INCLUDES POWER SERVICE CONNECTIONS, TELEPHONE SERVICE CONNECTIONS, PUBLIC ADDRESS SYSTEM CONNECTIONS AND FIRE ALARM SYSTEM CONNECTIONS.

B. ELEVATOR CONTROL WIRING AND INTERLOCK CONTROLS ARE NOT INCLUDED.

2. COMPONENTS

A. PROVIDE DISTRIBUTION PANELBOARD CIRCUIT BREAKER AND SHUNT-TRIP ELEVATOR MACHINE ROOM FUSED DISCONNECT WITH DRY CONTACTS FOR ELEVATOR DRIVE UNIT POWER, AND POWER WIRING COMPLETE TO THE DRIVE UNIT.

B. PROVIDE BRANCH CIRCUITS FOR ELEVATOR CAR LIGHTS, MACHINE ROOM GFCI RECEPTACLE, AND MACHINE ROOM LIGHTS; USE EMERGENCY POWER WHERE AVAILABLE.

C. PROVIDE CONDUIT FOR ELEVATOR COMMUNICATIONS SYSTEM.

D. PROVIDE CONDUIT AND WIRE FOR ELEVATOR RECALL SYSTEM; COORDINATE REQUIREMENTS WITH FIRE ALARM SYSTEM.

E. PROVIDE ELEVATOR PIT, TOP OF SHAFT AND MACHINE ROOM LIGHTS, RECEPTACLES AND SWITCHES PER CODE.

F. PROVIDE CONNECTIONS FOR ELEVATOR PIT SUMP PUMP (WHERE REQUIRED).

G. PROVIDE HEAT DETECTORS AT THE TOP OF THE SHAFT, PIT (WHERE REQUIRED) AND MACHINE ROOM, AND INTERLOCK WITH DRIVE UNIT POWER SUPPLY TO DISCONNECT POWER UPON SENSING OF FIRE AND BEFORE ACTIVATION OF ANY SPRINKLER HEADS.

H. PROVIDE LOCKING MECHANISMS FOR OVERCUUENT DEVICES ON BRANCH CIRCUITS SERVING ELEVATOR EQUIPMENT INCLUDING CAB, PIT AND MACHINE ROOM LIGHTING, VENTILATION, RECEPTACLES AND CONTROLLER POWER.

3. COORDINATION

A. COORDINATE ENTIRE INSTALLATION WITH ELEVATOR SYSTEM SUPPLIER PRIOR TO COMMENCEMENT OF WORK.

B. IF THE HORSEPOWER RATING OF THE EQUIPMENT FURNISHED BY THE ELEVATOR SUPPLIER DIFFERS FROM THE HORSEPOWER LISTED ON THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER PRIOR TO INSTALLING ANY WORK AND OBTAIN DIRECTION.

MECHANICAL EQUIPMENT WIRING

1. UNLESS OTHERWISE INDICATED OR SPECIFIED HEREIN, ALL MOTORS, MOTOR STARTERS, MOTOR CONTROLLERS, VARIABLE SPEED/FREQUENCY DRIVES, AND ASSOCIATED CONTROL DEVICES ARE FURNISHED BY DIVISION 23 AND INSTALLED UNDER THIS DIVISION. ALL LOCAL DISCONNECT SWITCHES UNLESS OTHERWISE NOTED ARE FURNISHED AND INSTALLED UNDER THIS DIVISION. COORDINATE INSTALLATION AND LOCATIONS WITH OTHER DIVISION CONTRACTORS.
2. POWER WIRING FROM THE INDICATED SOURCE TO THE STARTER/CONTROLLER/DRIVE UNIT, AND FROM THE STARTER/CONTROLLER/DRIVE UNIT TO THE MOTOR, INCLUDING ANY LOCAL DISCONNECT SWITCHES PROVIDED AND INSTALLED BY THIS DIVISION, AND ALL ASSOCIATED LUGS, TERMINALS, AND CONNECTIONS, ARE THE WORK OF THIS DIVISION.
3. CONTROL CIRCUIT WIRING IS GENERALLY FURNISHED AND INSTALLED UNDER OTHER DIVISIONS, EXCEPT THAT ANY SUCH WIRING SHOWN ON ELECTRICAL DRAWINGS IS WORK OF THIS DIVISION.
4. PROVIDE 120 VOLT POWER TO ALL TEMPERATURE CONTROL PANELS (TCP's) SUPPLIED AND INSTALLED BY MECHANICAL CONTRACTOR. USE EMERGENCY POWER SOURCES WHEN AVAILABLE. COORDINATE ALL POWER REQUIREMENTS AND PANEL LOCATIONS WITH TEMPERATURE CONTROLS CONTRACTOR.
5. COOPERATE AND COORDINATE WITH OTHER TRADES IN THE INSTALLATION, CONNECTION, AND TESTING OF MECHANICAL EQUIPMENT. PERFORM WORK OF THIS SECTION IN ACCORDANCE WITH EQUIPMENT MANUFACTURERS' INSTRUCTIONS.

COORDINATION DRAWINGS

1. DEVELOP AND SUBMIT COORDINATION DRAWINGS AS OUTLINED.

A. SHEET METAL, PLUMBING AND FIRE PROTECTION SHOP DRAWINGS THAT HAVE BEEN COORDINATED WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS SHAL BE SUBMITTED TO ENGINEER FOR REVIEW. DRAWINGS MUST BE RETURNED FROM ENGINEER EITHER "REVIEWED" OR "FURNISH AS CORRECTED" PRIOR TO BEING USED AS BASIS FOR COORDINATION DRAWINGS.

B. AFTER SHEET METAL AND PIPING DRAWINGS HAVE BEEN REVISED PER ENGINEERS COMMENTS, REPRODUCIBLE COPIES SHALL BE SENT TO THE TRADES IN THE FOLLOWING SEQUENCE FOR INCLUSION OF THEIR WORK:

- MECHANICAL SHEET METAL
- PLUMBING PIPING
- MECHANICAL PIPING
- SPRINKLER PIPING
- ELECTRICAL WORK

2. AFTER ALL TRADES HAVE INCLUDED THEIR WORK ON THE COORDINATION DRAWING AND NOTED CONFLICTS, ALL TRADES SHALL MEET TO RESOLVE CONFLICTS AND AGREE TO ACCEPTABLE SOLUTIONS. EACH TRADE SHALL SIGN COORDINATION DRAWINGS. ITEMS NOT SHOWN ON COORDINATION DRAWING IS RESPONSIBILITY OF OMITTING CONTRACTOR AND CONTRACTOR IS SUBJECT TO ADDITIONAL COSTS INCURRED BY OTHER TRADES.
3. THE ARCHITECT AND ENGINEER ARE NOT PART OF THE COORDINATION DRAWING PROCESS. THE ENGINEER WILL PROVIDE ASSISTANCE FOR NOTED CONFLICTS ONLY. COORDINATION DRAWINGS ARE NOT TO BE CONSIDERED PIPING OR DUCT SHOP DRAWINGS. THE CONTRACTOR IS REQUIRED TO SUBMIT INDIVIDUAL PIPING AND DUCTWORK SHOP DRAWINGS FOR REVIEW BY THE ENGINEER. PIPING AND DUCTWORK SHOP DRAWINGS SHALL FOLLOW THE DESIGN INTENT OF THE CONTRACT DOCUMENTS.
4. SUBMIT FINAL SIGNED COORDINATION DRAWING TO ENGINEER FOR REVIEW. ENGINEER WILL REVIEW COORDINATION DRAWINGS FOR GENERAL ARRANGEMENT AND FOR NOTED CONFLICTS ONLY. SPECIFIC INSTALLATION REQUIREMENTS WILL BE REVIEWED ONLY IN INDIVIDUAL TRADE SHOP DRAWINGS.
5. ANY WORK FABRICATED OR INSTALLED PRIOR TO SIGN OFF BY ALL TRADES WHICH IS DEEMED TO BE IN CONFLICT WITH COORDINATION DRAWINGS SHALL BE REMOVED AND RE-INSTALLED IN CONFORMANCE WITH COORDINATION DRAWINGS AT NO ADDITIONAL COST TO THE OWNER.
6. EACH CONTRACTOR (MENTIONED ABOVE) IS RESPONSIBLE FOR COORDINATION OF THEIR SUB-CONTRACTORS.
7. THE OVERALL COORDINATION OF THE COORDINATION PROCESS IS THE RESPONSIBILITY OF THE CONTRACTOR. THE ENGINEER IS NOT RESPONSIBLE FOR THE COORDINATION PROCESS. THE ENGINEER WILL RESPOND TO QUESTIONS THAT ARISE FROM THE COORDINATION PROCESS. DRAWINGS SUBMITTED WILL BE REVIEWED FOR CLEARLY IDENTIFIED CONFLICTS ONLY. SOLUTIONS TO CONFLICTS WILL NOT BEAR ADDITIONAL COST.

AS BUILT DRAWINGS

1. PROVIDE COMPLETE SET OF AS-BUILT DRAWINGS REFLECTING AS INSTALLED CONDITIONS. AS-BUILT DRAWINGS SHALL INDICATE ALL INSTALLED CONDITIONS OF SYSTEMS WITHIN THIS DISCIPLINE. DRAWINGS SHALL BE SIMILAR SCALE AS THE CONSTRUCTION DOCUMENTS AND INCLUDE DETAILS AS NECESSARY TO CLEARLY REFLECT THE INSTALLED CONDITION. DRAWINGS SHALL BE BOUND IN A COMPLETE AND CONSECUTIVE SET. SUPPLEMENTAL SKETCHES AND LOOSE PAPERWORK WILL NOT BE ACCETABLE AND WILL BE RETURNED FOR REVISION. THE CONTRACTOR SHALL COMPLY WITH THE ENGINEERS COMMENTS TO PRODUCE A CLEAR AND CONCISE SET OF DRAWINGS. DRAWINGS SHALL BE SUBMITTED AS INDICATED IN SECTION 017839.
2. PROVIDE "AS-BUILT DRAWINGS" INDICATING IN A NEAT AND ACCURATE MANNER A COMPLETE RECORD OF ALL REVISIONS TO THE ORIGINAL DESIGN OF THE WORK. INDICATE THE FOLLOWING INSTALLED CONDITIONS:

A. INCLUDE ALL CHANGES AND AN ACCURATE RECORD, ON REPRODUCTIONS OF THE CONTRACT DRAWINGS OR APPROPRIATE SHOP DRAWING.

B. DRAWINGS, OF ALL DEVIATIONS, BETWEEN THE WORK SHOWN AND THE WORK INSTALLED.

C. EQUIPMENT LOCATIONS (EXPOSED AND CONCEALED), DIMENSIONED FROM PROMINENT BUILDING LINES.

D. APPROVED SUBSTITUTIONS, CONTRACT MODIFICATIONS, AND ACTUAL EQUIPMENT AND MATERIALS INSTALLED.

E. SUBMIT FOR REVIEW BOUND SETS OF THE REQUIRED DRAWINGS, MANUALS AND OPERATING INSTRUCTIONS.

F. SUBMIT A COMPLETE MAINTENANCE MANUAL OF ALL EQUIPMENT INSTALLED UNDER THIS CONTRACT.

DEMOLITION AND REMOVAL NOTES (NOT ALL MAY APPLY)

1. THE EXISTING FACILITY WILL BE PARTIALLY OCCUPIED AND IN OPERATION DURING THE PERFORMANCE OF THE WORK.
2. WHEN NECESSARY TO TEMPORARILY DISCONNECT ANY EXISTING FEEDER OR BRANCH CIRCUIT SUPPLYING THE OCCUPIED PORTION OF THE FACILITY, CONFIRM WITH THE OWNER, AND SCHEDULE A MUTUALLY AGREEABLE PERIOD OF INTERRUPTION.
3. WHERE REPLACEMENT, RELOCATION OR MODIFICATION OF EXISTING EQUIPMENT IS INDICATED, PROVIDE AND MAINTAIN ALL TEMPORARY FEEDERS, CONNECTIONS, CIRCUIT PROTECTION, AND ANY OTHER MATERIALS AND APPURTENANCES REQUIRED TO MAINTAIN SERVICES TO THE OCCUPIED AREAS.
4. NO WORK SHALL BE LEFT INCOMPLETE, NOR ANY HAZARDOUS SITUATIONS CREATED, WHICH WILL AFFECT THE LIFE OR SAFETY OF THE PUBLIC AND/OR BUILDING OCCUPANTS. AT NO TIME SHALL THE WORK INTERFERE WITH OR CUT OFF ANY OF THE EXISTING SERVICES WITHOUT THE OWNER'S PRIOR WRITTEN PERMISSION.
5. THE OWNER RESERVES THE RIGHT TO OPERATE ALL EXISTING ELECTRICAL AND MECHANICAL EQUIPMENT NOT INCLUDED IN THIS WORK, AND TO PERFORM ALL REQUIRED SERVICING AND REPAIRS TO SAME, AT ALL TIMES.
6. IT IS REQUIRED THAT THE WORK INDICATED AND/OR SPECIFIED SHALL BE CARRIED OUT WITH A MINIMUM OF INTERFERENCE TO THE ESTABLISHED OPERATIONS OF THE BUILDING.
7. REMOVE, ABANDON, REROUTE, RELOCATE ANY CONDUIT, WIRING, LIGHTING FIXTURES, OUTLETS, AND OTHER ELECTRICAL ITEMS, WHICH ARE LAID BARE IN THE COURSE OF, OR INTERFERENCE WITH, THE ALTERATIONS. REMOVE ALL EXPOSED OUTLETS, CONDUIT, AND BRANCH CIRCUIT WORK, WHICH INTERFERE WITH THE ALTERATIONS.
8. IT IS THE INTENT OF THESE SPECIFICATIONS TO PROVIDE FOR THE CONTINUANCE OF ELECTRICAL SERVICES PRESENTLY INSTALLED IN THE UNALTERED AREAS. PROVIDE ALL CONDUIT, WIRING, AND DEVICES NECESSARY TO MAINTAIN SERVICES TO THESE AREAS.
9. COMPARE THE PLANS WITH THE EXISTING CONDITIONS TO DETERMINE THE AMOUNT OF WORK AFFECTED. REMOVE ALL UNUSED EXPOSED CIRCUIT WORK, OUTLETS, FIXTURES AND THE LIKE NOT REQUIRED BY THE ALTERATIONS.
10. ALL MATERIALS REQUIRED TO BE REMOVED AND NOT REINSTALLED UNDER THIS DIVISION OF WORK, UNLESS OTHERWISE INDICATED, SHALL BECOME THE PROPERTY OF THE CONTRACTOR, AND SHALL BE REMOVED FROM THE SITE.
11. WHERE FEEDERS AND BRANCH CIRCUITS OR DEVICES AND EQUIPMENT ARE INDICATED TO BE REMOVED, CONDUCTORS AND CABLES SHALL BE COMPLETELY REMOVED BACK TO THEIR SOURCE. EXPOSED OR ACCESSIBLE CONDUITS SHALL BE REMOVED COMPLETELY; CONDUITS EMBEDDED IN CONCRETE OR MASONRY SHALL BE CUT OFF FLUSH AND THE SURFACE PATCHED SMOOTH AND LEVEL.
12. REMOVED MATERIALS SHALL BE DISPOSED OF USING A LICENSED CARTING SERVICE.
13. CONTRACTOR SHALL REMOVE ALL ELECTRICAL EQUIPMENT IN OR ON WALLS THAT ARE TO BE REMOVED - MAINTAIN CONTINUITY OF ALL EXISTING BRANCH CIRCUITRY TO EXISTING ROOMS NOT BEING RENOVATED, REWIRE ALL EXISTING BRANCH CIRCUITS (THAT ARE TO REMAIN) AS REQUIRED. REFER TO ARCHITECTURAL DEMOLITION DRAWINGS FOR WALLS BEING REMOVED - REFER TO CONSTRUCTION SCHEDULE FOR TIME DELAY.
14. OUTAGES OF EXISTING ELECTRICAL (LIGHTING, POWER, AND SIGNAL) SYSTEMS NECESSITATED BY WORK OF ALL TRADES SHALL BE IN ACCORDANCE WITH FIELD SCHEDULES BY THE GENERAL CONTRACTOR AND OWNER - INCLUDE ALL ELECTRICAL WORK OVERTIME AND SUPERVISION TO COMPLY - CONTRACTOR SHALL OBTAIN OWNER'S AND GENERAL CONTRACTOR'S APPROVAL PRIOR TO DISRUPTING OF EXISTING ELECTRICAL SYSTEMS.
15. CONTRACTOR TO MAINTAIN CONTINUITY AND ACCESSIBILITY OF ALL EXISTING SYSTEMS AND SYSTEM EQUIPMENT FEEDERS WHICH MAY BE DISRUPTED FROM WORK OF OTHER TRADES.
16. ANY EXISTING ELECTRICAL WORK WHICH IS PULLED OUT OR CUT AWAY SHALL BE REMOVED FROM THE SITE AS DIRECTED BY THE GENERAL CONTRACTOR AND THE OWNER.
17. EXISTING ELECTRICAL EQUIPMENT WHICH IS NOT TO BE REUSED SHALL BE REMOVED FROM DRYWALL PARTITIONS. ANY OPENING IN THE EXISTING PARTITIONS BY REMOVAL OF EXISTING ELECTRICAL EQUIPMENT SHALL BE PATCHED BY THIS CONTRACTOR WITH MATERIALS TO MATCH EXISTING.
18. FOR PURPOSES OF THE CONTRACT, WHAT IS NOTED OR SHOWN ON THE DRAWINGS INDICATES THE SCOPE OF WORK REQUIRED AND THE QUALITY OF MATERIALS.
19. CONTRACTOR TO EXAMINE ALL CONTRACT DOCUMENTS AND PERFORM ALL DEMOLITION BOTH FOR AREAS BEING RENOVATED AND FOR AREAS WHICH MUST BE REWORKED TO PERMIT THE INSTALLATION OF WORK BY VARIOUS TRADES.
20. CONTRACTOR SHALL VISIT THE SITE AND VERIFY THE EXTENT OF DEMOLITION AND REMOVALS PRIOR TO THE SUBMISSION OF BIDS. NO CONSIDERATION SHALL BE GIVEN FOR FAILURE TO VISIT THE SITE.

ELECTRICAL DRAWING LIST

E001	GENERAL NOTES, ABBREVIATIONS & LEGEND
E100	PARTIAL FIRST FLOOR PLANS - LIGHTING
E200	PARTIAL FIRST & SECOND FLOOR PLANS - POWER
E600	DETAILS

ABBREVIATIONS (NOT ALL MAY BE USED)

A	AMPERES
ACR	AUTOMATICALLY CONTROLLED RECEPTACLE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AP	ACCESS POINT
BC	BATTERY CHARGER
BF	BOTTLE FILLER
BH	BLOCK HEATER
C	CONDUIT
CB	CIRCUIT BREAKER
CFW	COLD FOOD WELL
CKT	CIRCUIT
CR	CORD REEL
DO	DOOR OPERATOR
DW	DISHWASHER
EC	ELECTRICAL CONTRACTOR
EM	EMERGENCY (WIRED TO EMERGENCY SOURCE)
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EX	EXISTING TO REMAIN
FAA	FIRE ALARM ANNUNCIATOR
FACP	FIRE ALARM CONTROL PANEL
FB	FLOOR BOX
FF	FURNITURE FEED
FV	ELECTRONIC FLUSH VALVE
GFI	GROUND FAULT CIRCUIT INTERRUPTER
HD	HAND DRYER
HFW	HOT FOOD WELL
HM	HORIZONTALLY MOUNTED
HT	HEAT TRACE
JB	JUNCTION BOX
LC	LAPTOP CHARGING CART
LSS	LOCAL SOUND SYSTEM
MCB	MAIN CIRCUIT BREAKER
MD	MOTORIZED DAMPER
MLO	MAIN LUG ONLY
MPS	MOTORIZED PROJECTION SCREEN
MTD	MOUNTED
MON	MONITOR
OHD	OVERHEAD DOOR
PNL	PANELBOARD
POS	POINT OF SALE
PP	POWER POLE
PROJ	PROJECTOR
PT	POKETHROUGH
RELOC	RELOCATE/RELOCATED AT THE SAME HEIGHT (PER NEC REQUIREMENTS)
SB	SMARTBOARD
SF	SENSOR FAUCET
SG	SNEEZE GUARD
ST	SHUNT TRIP FOR ELEVATOR
TP	TRAP PRIMER
TR	TAMPER RESISTANT
UCR	UNDER COUNTER REFRIGERATOR
U.O.N.	UNLESS OTHERWISE NOTED
WG	WIRE GUARD
WP	WEATHERPROOF

ELECTRICAL SYMBOL LEGEND (NOT ALL MAY BE USED)

SYMBOL	DESCRIPTION
M	CEILING MOUNTED MICROPHONE (AUDIX M70 OR APPROVED EQUAL).
ICM	INTERCOM MASTER STATION.
ICD	INTERCOM SUBSTATION.
	WALL MOUNTED CLOCK.
	COMBINATION CLOCK/SPEAKER.
$V	VOLUME CONTROL SWITCH; MOUNT AT 48" A.F.F

SYMBOL	DESCRIPTION
MM	FIRE ALARM MONITORING MODULE DEVICE
CM	FIRE ALARM CONTROL MODULE DEVICE
EPO	EMERGENCY POWER OFF SWITCH (EPO)
DO	GARAGE DOOR OPERATOR
P	PUSH PLATE DOOR OPERATOR, PROVIDED WITH DOOR HARDWARE WIRED BY CONTRACTOR
CR	CARD READER
DC	DOOR CONTACT
K	SECURITY KEYPAD
	EXTERIOR SECURITY CAMERA
	INTERIOR DOME SECURITY CAMERA
AP	WALL MOUNTED DATA JACK: #D DEPICTS # OF JACKS NEEDED, PROVIDE 1 OTHERWISE.
AP	CEILING MOUNTED WIRELESS ACCESS POINT : #D DEPICTS # OF JACKS NEEDED, PROVIDE 1 OTHERWISE.
TV	COAX JACK
	CEILING MOUNTED DATA JACK: #D DEPICTS # OF JACKS NEEDED, PROVIDE 1 OTHERWISE.
	DATA JACK: #D/#V DEPICTS # OF JACKS NEEDED, PROVIDE 1 OTHERWISE.
	FLOOR MOUNTED DATA JACK: #D DEPICTS # OF JACKS NEEDED, PROVIDE 1 OTHERWISE.
	VOICE JACK: #V DEPICTS # OF JACKS NEEDED, PROVIDE 1 OTHERWISE.
MON	A/V JACK FOR 75" SCREEN/TV: HDMI & USB-C INPUTS - ATLONA #AT-OME-SW21-TX-WPC OR APPROVED EQUAL
S	TRUMPET WALL SPEAKER
S	EXTERIOR WALL SPEAKER / HORN
S	CEILING MOUNTED SPEAKER.
S	WALL MOUNTED SPEAKER.

SYMBOL	DESCRIPTION
CR	CORD REEL; SEE FLOOR PLANS FOR DETAILS
B	ELECTRICAL ALARM BELL
E	CALL-FOR-AID CORRIDOR LIGHT/BUZZER, MOUNT AT 7'-6" AFF
E	CALL-FOR-AID SWITCH. MOUNT AT 36" AFF WITH PULL CORD HANGING DOWN TO 6" AFF
CKT	BRANCH CIRCUIT HOMERUN (PANEL/CIRCUIT DESIGNATION)
CKT	BRANCH CIRCUIT WIRING
CKT	CONTROL CIRCUIT WIRING
OC	CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR (INFRARED/ULTRASONIC) WITH 360° COVERAGE
OC HB	CEILING MOUNTED HIGH BAY DUAL TECHNOLOGY OCCUPANCY SENSOR (15-45 FT HIGH MOUNTING RANGE) WITH 360° COVERAGE
OC	WALL OR CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSOR (INFRARED/ULTRASONIC) WITH 180° COVERAGE
F	FIRE ALARM MANUAL PULL STATION - 48"AFF U.O.N.
	FIRE ALARM AUDIO/VISUAL DEVICE - 80"AFF U.O.N.
	FIRE ALARM STROBE LIGHT - 80"AFF U.O.N.
S	SMOKE DETECTOR; "R" DENOTES ELEVATOR RECALL DEVICE
CO	CARBON MONOXIDE DETECTOR
H	HEAT DETECTOR; 135° U.O.N.; ST DENOTES FOR ELEVATOR SHUNT TRIP
S D	DUCT MOUNTED IONIZATION SMOKE DETECTOR
TS	TAMPER SWITCH
FS	FLOW SWITCH
PS	PRESSURE SWITCH
M	MAGNETIC DOOR HOLD OPEN
X	TEST SWITCH WITH REMOTE INDICATOR LIGHT FOR DUCT SMOKE DETECTOR, NUMBER INDICATES QUANTITY AT THAT LOCATION

SYMBOL	DESCRIPTION
$3	3-WAY SWITCH; MOUNT AT 48" AFF
$4	4-WAY SWITCH; MOUNT AT 48" AFF
$M	DUAL TECHNOLOGY, OCCUPANCY SENSOR SWITCH; MOUNT AT 48" AFF
$D	DIMMING SWITCH; MOUNT AT 48" AFF, COMPATIBLE WITH LOAD CONTROLLED
$3D	MULTI-LOCATION DIMMING SWITCH; MOUNT AT 48" AFF, COMPATIBLE WITH LOAD CONTROLLED
$K	KEYED SINGLE POLE SWITCH; MOUNT AT 48" AFF
$3K	KEYED 3-WAY SWITCH; MOUNT AT 48" AFF
$4K	KEYED 4-WAY SWITCH; MOUNT AT 48" AFF
$P	SINGLE POLE SWITCH WITH PILOT LIGHT; MOUNT AT 48" AFF
$3P	3-WAY SWITCH WITH PILOT LIGHT; MOUNT AT 48" AFF
	SINGLE RECEPTACLE; MOUNT AT 18" AFF UNLESS OTHERWISE SPECIFIED
	DUPLEX RECEPTACLE; MOUNT AT 18" AFF UNLESS OTHERWISE SPECIFIED
	DUPLEX RECEPTACLE; MOUNTED 6" ABOVE COUNTER/COMPUTER SHELF OR 48" TO TOP OF DEVICE (NOT OVER A COUNTER) UNLESS OTHERWISE NOTED. "HM" DENOTES DEVICE TO BE HORIZONTALLY MOUNTED.
WP	RECEPTACLE WITH OUTDOOR RATED "IN-USE" COVER PLATE, PROVIDE FLUSH MOUNTED BOX
ACR	AUTOMATICALLY CONTROLLED RECEPTACLE; HALF THE DEVICE SHALL BE CONTROLLED BY ROOM OCCUPANCY/VACANCY SENSOR PER THE ENERGY CODE WHILE THE OTHER HALF IS WIRED DIRECTLY TO A BRANCH CIRCUIT. DEVICE SHALL HAVE NEC MARKING DENOTING SWITCHED PORTION.
	QUAD RECEPTACLE; MOUNT AT 18" AFF UNLESS OTHERWISE SPECIFIED
	QUAD RECEPTACLE; MOUNTED 6" ABOVE COUNTER/COMPUTER SHELF OR 48" TO TOP OF DEVICE (NOT OVER A COUNTER) UNLESS OTHERWISE NOTED
	SPECIAL OUTLET CONFIGURATION, COORDINATE NEMA# WITH EQUIPMENT & RATING WITH PANEL SCHEDULE.
	CEILING MOUNTED DUPLEX RECEPTACLE; PROVIDE FLUSH MOUNTED BOX
	FLOOR MOUNTED RECEPTACLE; SEE FLOOR PLANS FOR DETAILS

SYMBOL	DESCRIPTION
	DISTRIBUTION PANEL, 480/277 OR 120/208V
	ELECTRICAL PANEL, 480/277V
	ELECTRICAL PANEL, 120/208V
	PANELBOARD FLUSH MOUNTED, 120/208V
	PANELBOARD SURFACE MOUNTED, 120/208 V
	NON-FUSED DISCONNECT SWITCH
	FUSED DISCONNECT SWITCH
J	WALL MOUNTED JUNCTION BOX, ACCORDING TO NEC REQUIREMENTS
J	CEILING MOUNTED JUNCTION BOX, ACCORDING TO NEC REQUIREMENTS
J XX / J XX	JUNCTION BOX FOR MULTIPURPOSE; REFER TO ABBREVIATIONS LIST FOR LETTERS NEXT TO BOX
EM / EM	RECESSED LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE; EM INDICATES EMERGENCY
	TYPICAL WALL MOUNTED LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE
	TYPICAL RECESSED LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE
	LIGHT FIXTURE CONNECTED TO THE EMERGENCY DISTRIBUTION SYSTEM OR INVERTER
EM	TYPICAL LINEAR RECESSED LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE; EM INDICATES EMERGENCY
EM	TYPICAL PENDANT/CHAIN HUNG LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE; EM INDICATES EMERGENCY
EM	TYPICAL SURFACE MOUNTED LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE; EM INDICATES EMERGENCY
	TYPICAL SHOEBOX LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE
	TYPICAL EXTERIOR WALL MOUNTED LIGHT FIXTURE; LETTER INDICATES FIXTURE TYPE
	CEILING MOUNTED EXIT SIGN, SHADING INDICATES DIRECTION OF FIXTURE FACE, ARROW INDICATES DIRECTION OF CHEVRON, PROVIDE UNSWITCHED POWER FROM AREA LIGHTING CIRCUIT
	DOUBLE FACE EXIT SIGN
$	SINGLE POLE SWITCH OR DISCONNECT; MOUNT AT 48" AFF, OR AT EQUIPMENT

Project Title:

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SECURE ENTRANCE
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SILVER PETRUCELLI + ASSOCIATES
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Revision:	Description:	Date:	Revised By:

Drawing Title: GENERAL NOTES, ABBREVIATIONS & LEGEND

Project Phase: ISSUED FOR BID

State Project Number: N/A

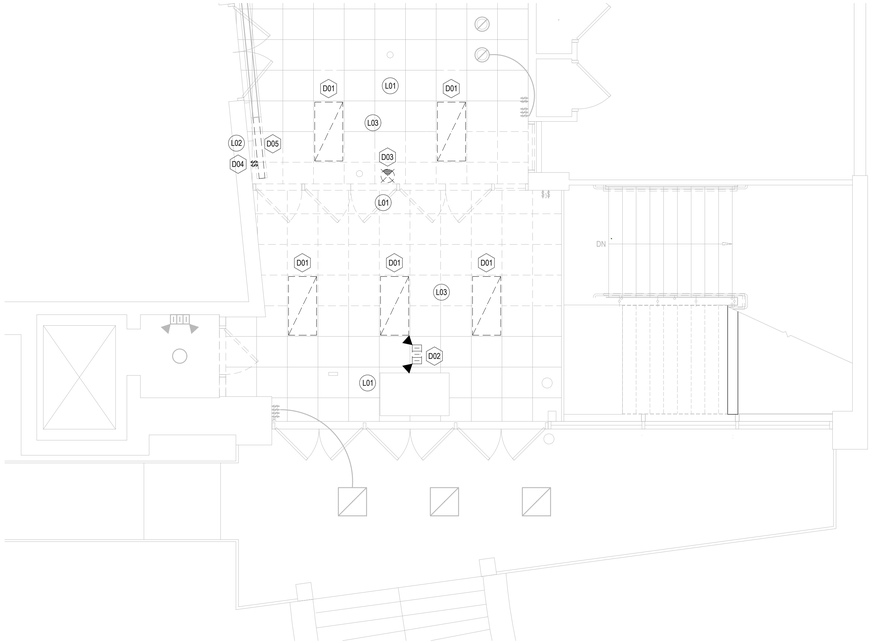
Date: 11/10/2026

Scale: AS NOTED

Drawn By: S. CROTEAU

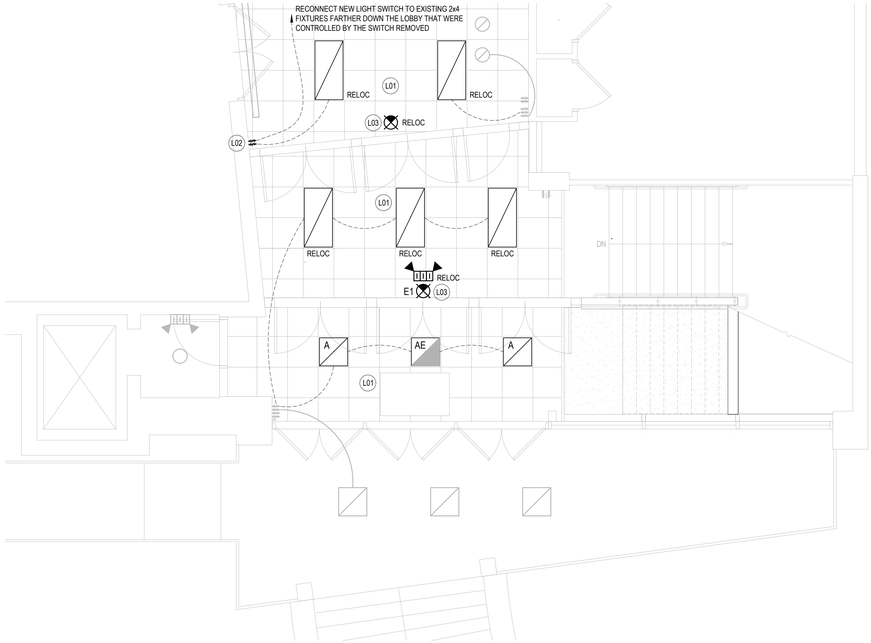
Project Number: 24-179

Drawing Number: E001



1 PARTIAL FIRST FLOOR DEMOLITION PLAN

1/4"=1'-0"



2 PARTIAL FIRST FLOOR PLAN

1/4"=1'-0"

GENERAL DEMOLITION NOTES

1. REFER TO DRAWING E001 FOR SYMBOLS AND ABBREVIATIONS AND GENERAL NOTES.
2. ALL WORK SHALL CONFORM WITH THE ELECTRICAL SPECIFICATIONS AND THE LATEST ACCEPTED NATIONAL ELECTRICAL CODE (NEC).
3. ALL EXISTING LIGHT FIXTURES, LIGHT SWITCHES, EXIT SIGNS, ETC. SHOWN DARK AND DASHED OR SOLID ARE TO BE REMOVED UNLESS OTHERWISE NOTED. ALL EXISTING DEVICES SHOWN SOLID AND HALF-TONE (LIGHT), ARE EXISTING TO REMAIN AND ALL WIRING TO THESE DEVICES SHALL REMAIN WIRED TO THEIR EXISTING BRANCH CIRCUIT(S). CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE CONTINUITY OF ALL EXISTING BRANCH CIRCUITS AFFECTED BY THE RENOVATION AND PROVIDE ADDITIONAL WIRING AS NEEDED.

(DXX) DEMOLITION KEY NOTES

D01 CONTRACTOR SHALL DISCONNECT, REMOVE AND RELOCATE EXISTING RECESSED 2x4 LIGHT FIXTURE INDICATED (SHOWN DARK & DASHED). EXISTING BRANCH CIRCUIT & CONTROL WIRING SHALL BE MADE SAFE TO SERVE RELOCATED FIXTURE. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED LIGHT FIXTURE.

D02 CONTRACTOR SHALL DISCONNECT, REMOVE AND RELOCATE EXISTING TWIN-HEAD EMERGENCY LIGHT FIXTURE (SHOWN DARK & DASHED) INSTALLED ABOVE THE CEILING IN THIS LOCATION. CONFIRM FIXTURE AND BATTERY ARE WORKING PROPERLY BEFORE RELOCTING DEVICE. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED LIGHT FIXTURE.

D03 CONTRACTOR SHALL DISCONNECT, REMOVE AND RELOCATE EXISTING CEILING MOUNTED EXIT SIGN INDICATED (SHOWN DARK & DASHED). EXISTING BRANCH CIRCUIT WIRING SHALL BE MADE SAFE TO SERVE RELOCATED FIXTURE IN THIS AREA. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED EXIT SIGN.

D04 CONTRACTOR SHALL DISCONNECT AND REMOVE EXISTING RECESSED MOUNTED TOGGLE TYPE LIGHT SWITCHES INDICATED (SHOWN DARK & SOLID), ALONG WITH BACK BOX AND COVER PLATE. EXISTING BRANCH CIRCUIT & CONTROL WIRING SHALL BE MADE SAFE TO SERVE RELOCATED FIXTURE IN THIS AREA. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED EXIT SIGN.

D05 CONTRACTOR SHALL REMOVE 4 FEET OF EXISTING WALL MOUNTED VALANCE LIGHT FIXTURE INDICATED (SHOWN DARK & DASHED) OR TO END OF NEAREST ILLUMINATED SECTION. THE REMAINING LENGTH OF FIXTURE SHALL REMAIN AND BE COMPLETELY OPERATIONAL.

(LXX) LIGHTING KEY NOTES

L01 CONTRACTOR SHALL WIRE NEW AND/OR RELOCATED LIGHT FIXTURES IN THIS ROOM TO EXISTING BRANCH CIRCUIT THAT PREVIOUSLY SERVED LIGHTING IN THIS AREA. INSTALL NEW CONTROL WIRING INDICATED TO EXISTING LIGHT SWITCH.

L02 CONTRACTOR SHALL INSTALL NEW LIGHT SWITCHES (SINGLE POLE OR 3-WAY) TO CONTROL RELOCATED AND EXISTING TO REMAIN LIGHT FIXTURES IN THIS AREA THAT THE PREVIOUS SWITCHES REMOVED DURING DEMOLITION PHASE CONTROLLED.

L03 CONTRACTOR SHALL WIRE NEW AND RELOCATED EXIT SIGNS AND RELOCATED TWIN HEAD EMERGENCY LIGHT FIXTURE TO EXISTING BRANCH CIRCUIT SERVING THIS AREA IN FRONT OF ALL LOCAL SWITCHING.

LIGHTING FIXTURE SCHEDULE

DESIGNATION	DESCRIPTION	MANUFACTURER/ MODEL NUMBER	LAMP			ELECTRICAL			NOTES
			TYPE	COLOR TEMP	NO	DRIVER	VOLTAGE	WATTS	
A	RECESSED MOUNTED 2FT x 2FT SELECTABLE FLAT PANEL LED LIGHT FIXTURE WITH WHITE FINISH AND FROSTED WHITE LENS (2600/3600/4500 LUMEN PACKAGES) WITH (35K/40K/50K CCT)	LITHONIA LIGHTING #CPX 2X2 ALO7 80CRI SWW7 SWL MVOLT	LED	MATCH EXISTING		DIMMING	120/277	20.5/28/35	
AE	SAME AS TYPE 'A' EXCEPT WITH AN EMERGENCY BATTERY FOR MINIMUM OF 90 MINUTES	LITHONIA LIGHTING #CPX 2X2 ALO7 80CRI SWW7 SWL MVOLT E10W	LED	MATCH EXISTING		DIMMING	120/277	20.5/28/35	
E1	CEILING MOUNTED SINGLE FACE LED EXIT SIGN WITH WITH WHITE THERMOPLASTIC, RED LETTERS & EMERGENCY BATTERY FOR MINIMUM OF 90 MINUTES	LITHONIA LIGHTING #EWRG EL M6	LED	NA		ELECTRONIC	120/277	1	(4) (7)

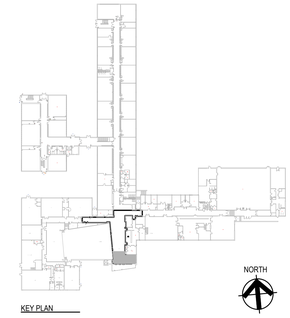
LIGHT FIXTURE NOTES:

1. ALL ELECTRONIC DRIVERS SHALL HAVE A MAXIMUM TOTAL HARMONIC DISTORTION OF BETWEEN TEN & FIFTEEN PERCENT (10-15%).
2. COLOR OF ALL LAMPS SHALL MATCH COLOR OF EXISTING FIXTURES IN BUILDING.
3. FURNISH ALL ADDITIONAL MATERIALS AND ACCESSORIES REQUIRED FOR COMPLETE INSTALLATION TO BE FULLY OPERATIONAL.

(4) FURNISH WITH EMERGENCY BATTERY PACK FOR MINIMUM 90 MINUTE EMERGENCY LIGHTING OPERATION WITH TEST SWITCH AND INDICATOR LIGHT.

5. CONTRACTOR SHALL VERIFY ALL CEILING TYPES AND/OR COORDINATE ALL FIXTURE TRIMS PRIOR TO PURCHASE OF FIXTURES.
6. FURNISH ALL ADDITIONAL MATERIALS AND ACCESSORIES REQUIRED FOR COMPLETE INSTALLATION TO BE FULLY OPERATIONAL.

(7) PROVIDE WITH FEATURES AND ACCESSORIES NECESSARY FOR UNIVERSAL MOUNTING AND DIRECTIONAL ARROW KNOCKOUTS. ARROWS ON PLAN INDICATE DIRECTION OF CHEVRONS. SHADING INDICATES QUANTITY AND LOCATION OF FIXTURE FACE.



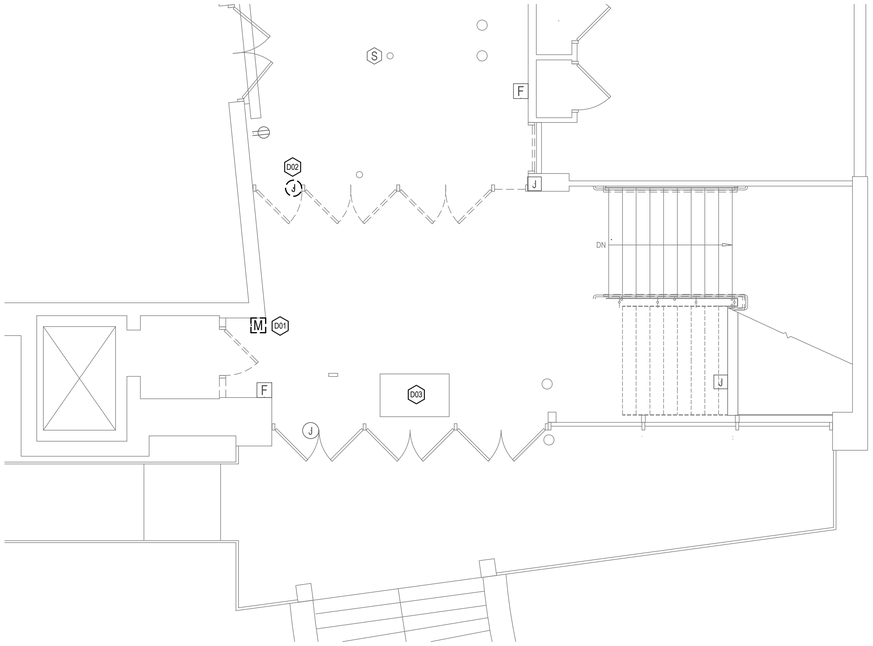
KEY PLAN

Project Title:
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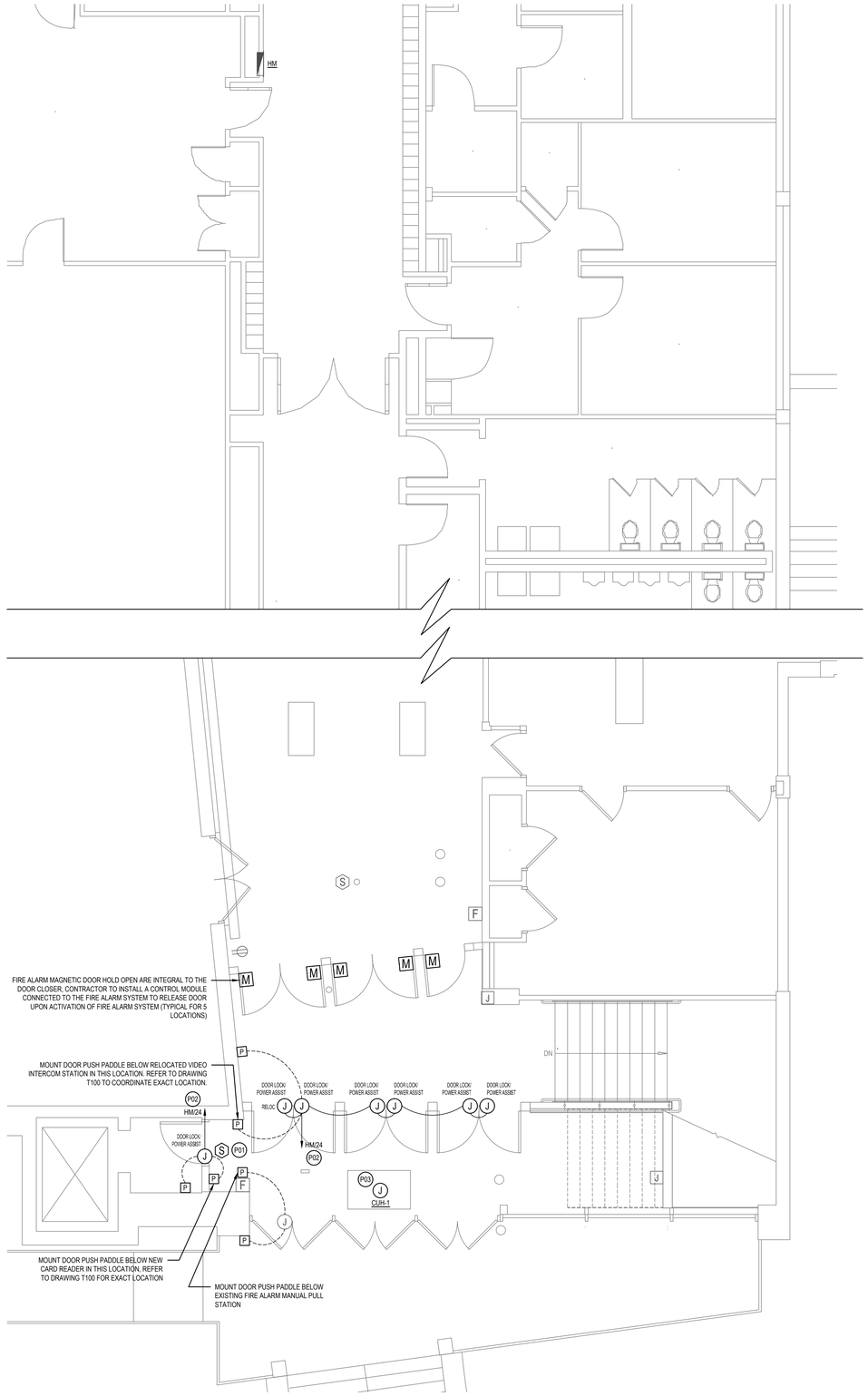
Revision:	Description:	Date:	Revised By:

Drawing Title: PARTIAL FIRST FLOOR PLANS - LIGHTING
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Date: 11/10/2026
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Drawn By: S. CROTEAU
Project Number: 24-179
Drawing Number: E100



1 PARTIAL FIRST FLOOR DEMOLITION PLAN
1/4"=1'-0"

3 PARTIAL SECOND FLOOR PLAN
1/4"=1'-0"



2 PARTIAL FIRST FLOOR PLAN
1/4"=1'-0"

GENERAL DEMOLITION NOTES

1. REFER TO DRAWING E001 FOR SYMBOLS AND ABBREVIATIONS AND GENERAL NOTES.
2. ALL WORK SHALL CONFORM WITH THE ELECTRICAL SPECIFICATIONS AND THE LATEST ACCEPTED NATIONAL ELECTRICAL CODE (NEC).
3. ALL EXISTING DEVICES (RECEPTACLES, FIRE ALARM, TECHNOLOGY, ETC.) SHOWN DARK AND DASHED OR SOLID ARE TO BE REMOVED UNLESS OTHERWISE NOTED. ALL EXISTING DEVICES SHOWN SOLID AND HALF-TONE (LIGHT), ARE EXISTING TO REMAIN AND ALL WIRING TO THESE DEVICES SHALL REMAIN WIRED TO THEIR EXISTING BRANCH CIRCUIT(S). CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE CONTINUITY OF ALL EXISTING BRANCH CIRCUITS AFFECTED BY THE RENOVATION AND PROVIDE ADDITIONAL WIRING AS NEEDED.

(DXX) DEMOLITION KEY NOTES

D01 CONTRACTOR SHALL DISCONNECT AND REMOVE EXISTING FIRE ALARM MAGNETIC HOLD OPEN INDICATED (SHOWN DARK & SOLID). EXISTING WIRING SHALL BE REMOVED COMPLETELY BACK TO POINT OF ORIGIN ALONG WITH SURFACE MOUNTED BACK BOX AND RACEWAY.

D02 CONTRACTOR SHALL DISCONNECT, REMOVE AND MAKE SAFE EXISTING POWER CONNECTION TO DOOR LOCK INDICATED TO BE REMOVED TO SERVE NEW DOOR LOCK IN THIS AREA. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED POWER CONNECTION.

D03 CONTRACTOR SHALL DISCONNECT, REMOVE AND MAKE SAFE EXISTING POWER CONNECTION TO CEILING MOUNTED UNIT HEATER INDICATED TO BE REMOVED. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED POWER CONNECTION.

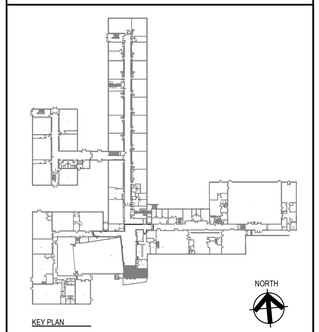
D04 CONTRACTOR SHALL DISCONNECT AND REMOVE EXISTING FLOOR MOUNTED FIRE ALARM MAGNETIC HOLD OPEN INDICATED (SHOWN DARK & SOLID). EXISTING WIRING SHALL BE REMOVED COMPLETELY BACK TO POINT OF ORIGIN ALONG WITH SURFACE MOUNTED BACK BOX AND RACEWAY.

(PXX) POWER KEY NOTES

P01 CONTRACTOR SHALL CONNECT SMOKE DETECTOR WITH TRANSFER GRILLE DAMPER SO THAT ACTIVATION OF FIRE ALARM SYSTEM OR LOCAL SMOKE DETECTOR WILL ACTIVATE THE FUSIBLE LINK TO CLOSE THE DAMPER.

P02 CONTRACTOR SHALL WIRE NEW DOOR ELECTRIC LOCKS AND POWER ASSIST OPERATORS TO EXISTING SPARE 20A-1P CIRCUIT BREAKER IN PANEL 'HM'. CONFIRM EXISTING SPARE CIRCUIT AND UPDATE EXISTING PANEL DIRECTORY TO REFLECT THIS CHANGE. RUN 2 #12 + #12G IN 3/4C. FROM PANEL TO DOORS. POWER SUPPLY CONNECTION FOR THE ELECTRIC LOCKS SHOULD BE IN THE DSX PANEL IN THE LOCAL IT CLOSET. COORDINATE LOCATION AND EXACT POWER REQUIREMENT WITH APPROVED HARDWARE SET SUBMITTAL.

P03 CONTRACTOR SHALL CONNECT NEW CEILING MOUNTED CABINET UNIT HEATER (CUH-1) TO EXISTING BRANCH CIRCUIT THAT PREVIOUSLY SERVED CABINET UNIT HEATER REMOVED IN THIS LOCATION.



KEY PLAN

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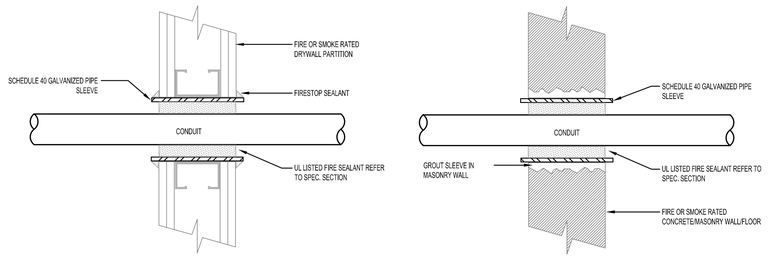
Revision:	Description:	Date:	Revised By:

Drawing Title: PARTIAL FIRST & SECOND FLOOR PLANS - POWER
Project Phase: ISSUED FOR BID
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Drawn By: S. CROTEAU
Project Number: 24-179
Drawing Number: E200

GENERAL NOTES:

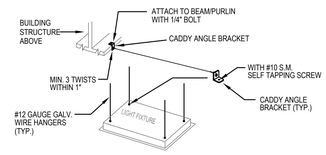
PROVIDE UL LISTED FIRE/SMOKE PENETRATION ASSEMBLY IN ACCORDANCE W/ UL1479, ASTM E814 REQUIREMENTS FOR WALL TYPE, RATING, PIPE SIZE INSTALLED.

FIRESTOPPING SHALL HAVE A RATING EQUAL TO OR GREATER THAN THE WALL/FLOOR BEING PENETRATED - SEE SPECIFICATIONS. REFER TO ARCHITECTURAL DRAWINGS FOR WALL/FLOOR RATINGS AND LOCATIONS.



1 WALL/FLOOR PENETRATION W/FIRE-SMOKE SEAL DETAIL

NOT TO SCALE

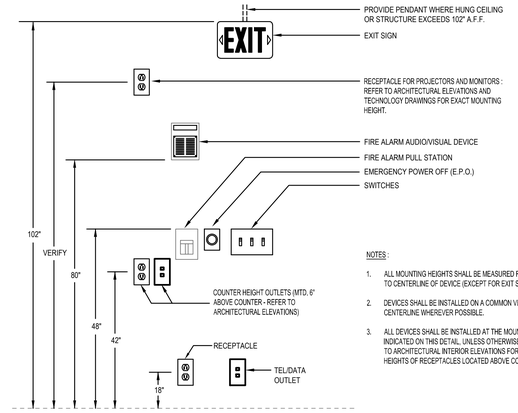


NOTES:

1. ALL LIGHTING FIXTURES SHALL BE SECURED TO THE STRUCTURE BY THE ELECTRICAL CONTRACTOR.
2. FLUSH OR RECESSED LIGHT FIXTURES LESS THAN 56 POUNDS SHALL HAVE 2 - 12 GA. SLACK SAFETY WIRES FROM DIAGONAL CORNERS TO BUILDING STRUCTURE BY TRADE CONTRACTOR.
3. FLUSH OR RECESSED LIGHT FIXTURES MORE THAN 56 POUNDS SHALL HAVE 4 - 12 GA. SLACK SAFETY WIRES FROM DIAGONAL CORNERS TO BUILDING STRUCTURE BY TRADE CONTRACTOR.
4. SECURE SURFACE MOUNTED LIGHT FIXTURES W/ MINIMUM OF 2 - POSITIVE CLAMPING DEVICES OF 14 GA. MINIMUM STEEL AND W/ 12 GA. WIRE TO BUILDING STRUCTURE.

2 TYPICAL LAY-IN GRID LIGHT FIXTURE SUPPORT/MOUNTING DETAIL

NOT TO SCALE



NOTES :

1. ALL MOUNTING HEIGHTS SHALL BE MEASURED FROM FIN. FLOOR TO CENTERLINE OF DEVICE (EXCEPT FOR EXIT SIGNS).
2. DEVICES SHALL BE INSTALLED ON A COMMON VERTICAL CENTERLINE WHEREVER POSSIBLE.
3. ALL DEVICES SHALL BE INSTALLED AT THE MOUNTING HEIGHTS INDICATED ON THIS DETAIL, UNLESS OTHERWISE NOTED. REFER TO ARCHITECTURAL INTERIOR ELEVATIONS FOR MOUNTING HEIGHTS OF RECEPTACLES LOCATED ABOVE COUNTERS.

3 TYPICAL DEVICE MOUNTING HEIGHT DETAIL

NOT TO SCALE

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Drawn By: S. CROTEAU
Project Number: 24-179
Drawing Number: E600

GENERAL NOTES

1. DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS AND WORK INCLUDED IN THE CONTRACT.
2. ALL COMMUNICATIONS OUTLETS MUST COINCIDE WITH ELECTRICAL POWER DRAWINGS AND SECURITY DEVICES. THE CONTRACTOR MUST COORDINATE ALL LOCATIONS OF THE ELECTRICAL OUTLETS WITH THE DATA OUTLETS.
3. REQUIRED CABLE COLORS: SUBMIT ALL CABLE AND JACK COLORS WITH PRODUCT SUBMITTALS PRIOR TO PROCUREMENT.
4. LABEL ALL CABLES WITHIN 12" OF THE FINAL TERMINATION..
5. CONTRACTOR SHALL MAINTAIN THE TWIST OF THE INDIVIDUAL PAIRS TO WITHIN 1/2" OF FINAL TERMINATION FOR ALL CATEGORY 3 OR HIGHER CABLE.
6. USE ONLY HOOK AND LOOP CABLE TIES (VELCRO) FOR CABLES RATED CATEGORY 3 OR HIGHER.
7. ALL CABLES RUN IN CEILING AREAS SHALL BE PROPERLY SUPPORTED WITH CONDUIT OR J-HOOKS MOUNTED TO SLAT AT MINIMUM OF 5' INTERVALS. NO CABLE SHALL REST OR TOUCH CEILING ASSEMBLIES. CABLES SHALL NOT BE INSTALLED EXPOSED ON OPEN CEILING AREAS.
8. ALL LABELS SHALL BE MACHINE PRINTED. NO HAND LETTERED CABLES SHALL BE USED.
9. USE ONLY PLENUM RATED CABLES.
10. DO NOT RUN ETHERNET CABLES PARALLEL TO POWER CABLES. CROSS POWER CABLES ONLY AT RIGHT ANGLES.
11. MAINTAIN 8" DISTANCE FROM ALL LIGHTING TRANSFORMERS.
12. COLOR AND STYLE OF COMMUNICATIONS FACE PLATES SHALL MATCH ELECTRICAL FACE PLATES AND BE COORDINATED WITH AND CONFIRMED BY THE ARCHITECT.
13. OBTAIN AND EXTEND TO OWNER ALL AVAILABLE MANUFACTURER AND SYSTEM WARRANTEES. LOW VOLTAGE INSTALLATION CONTRACTOR SHALL SUBMIT ALL TEST RESULTS. THE CABLE MANUFACTURER TO CERTIFY THE CABLING INSTALLATION AND ATTAIN AND DELIVER TO THE OWNER THE EXTENDED MANUFACTURER'S WARRANTY FOR MATERIAL AND WORKMANSHIP.
14. SPLICING CABLES IS NOT PERMITTED EXCEPT AS SPECIFICALLY NOTED.
15. DEVICE CABLING SHALL BE TERMINATED WITHIN THE INDICATED DATA ROOMS AND SHALL BE TERMINATED ONTO A 19" RACK MOUNTED, RJ45, 24 PORT, CATEGORY 6A RATED PATCH PANEL.
16. THE FOLLOWING CABLING SHALL BE TERMINATED ONTO IT'S OWN DISCRETE AND SEPARATE CATEGORY 6A RATED, RACK MOUNTED PATCH PANELS. REFER TO RACK ELEVATION DETAILS:
    - ALL WIRELESS AP'S
    - ALL VIDEO SURVEILLANCE CAMERAS (REFER TO SECURITY DRAWINGS FOR PLACEMENT)
17. LOCATIONS OF EQUIPMENT FOR ALL OTHER TRADES SHALL BE COORDINATED BEFORE CONSTRUCTION.
18. CONTRACTOR SHALL COORDINATE LAYOUT LOCATIONS AND CLEARANCE OF ALL EQUIPMENT WITH OTHER TRADES AND ATTAIN OWNER'S APPROVAL PRIOR TO INSTALLATION.
19. CONTRACTOR SHALL COORDINATE ALL RACEWAYS, LOCATIONS, AND POWER REQUIREMENTS WITH THE ELECTRICAL CONTRACTOR.
20. ALL VOICE AND DATA OUTLETS THAT DO NOT HAVE AN ELECTRICAL OUTLET WITHIN 3FT SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE PROJECT ARCHITECT, CONSTRUCTION MANAGER, AND TECHNOLOGY CONSULTANT PRIOR TO THE TIME OF INSTALLATION.
21. ALL DEVICES SHOWN ON THESE PLANS MUST BE COORDINATED AND APPROVED BY THE ARCHITECT. THE INSTALLATION CONTRACTOR SHALL DEPICT ALL DEVICES ONTO ELEVATION SUBMITTALS BEFORE INSTALLATION. ANY DEVICE THAT IS NOT APPROVED BY THE ARCHITECT PRIOR TO INSTALLATION MAY BE REQUIRED TO BE RELOCATED AS DIRECTED BY THE ARCHITECT AND CORRECTED BY THE CONTRACTOR WITH NO ADDITIONAL CHARGE TO THE PROJECT.
22. ALL PATHWAYS, INCLUDING ALL WALL AND CEILING PENETRATIONS ARE REQUIRED TO INSTALL CABLING TO THE END DEVICE AND SHALL BE COORDINATED BETWEEN THE LOW VOLTAGE AND SECURITY CONTRACTOR AND THE ELECTRICAL CONTRACTOR AND SHALL BE INCLUDED AS PART OF THIS SECTION.
23. SECURE ATTACHMENT OF TECHNOLOGY AND SECURITY DEVICES:
    - TO ENSURE PROPER ATTACHMENT OF FIXTURES, FURNISHINGS & EQUIPMENT ITEMS, INCLUDING TECHNOLOGY ITEMS, WHERE "ITEMS" ARE ATTACHED TO WALL, CEILING, OVERHEAD STRUCTURE, AND/OR FLOOR, CONTRACTOR SHALL PROVIDE INFORMATION ADEQUATE FOR ARCHITECT TO VERIFY ITEMS, ATTACHED SECURELY AND PER MANUFACTURER'S RECOMMENDATIONS. ARCHITECT'S REVIEW MAY BE IMPLEMENTED DURING SUBMITTAL PROCESS.
    - CONTRACTOR SHALL PROVIDE STRUTS, HANGERS, FASTENERS, SAFETY HARNESSES, CHANNELS, BOLTS, SCREWS,RODS, ETC. TO SECURELY ATTACH ITEMS TO THE EXISTING STRUCTURE AS REQUIRED TO MEET FIELD CONDITIONS AND MEET APPLICABLE CODES.
24. ALL CONDUIT ARE TO BE INSTALLED TO ABOVE ACCESSIBLE CEILING UNLESS OTHERWISE NOTED.
25. PLACEMENT OF ALL SECURITY VIDEO SURVEILLANCE CAMERAS MUST BE APPROVED BY THE SECURITY CONSULTANT AND/OR OWNER PRIOR TO CONSTRUCTION.

TECHNOLOGY DRAWING LIST

T001	GENERAL NOTES, ABBREVIATIONS & LEGEND
T100	PARTIAL FIRST & SECOND FLOOR PLANS - TECHNOLOGY
T600	DETAILS

ABBREVIATIONS (NOT ALL MAY BE USED)

AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
A/C	ABOVE COUNTER
ANSI	AMERICAN NATIONAL STANDARDS
A/R	AS REQUIRED
BICSI	BUILDING INDUSTRY CONSULTING SERVICE INTERNATIONAL
BNC	BAYONET NEIL-CONCELMAN
C	CONDUIT
DEMARC	DEMARCATION
DPDT	DOUBLE PULL DOUBLE THROW
EIA	ELECTRONICS INDUSTRIES ALLIANCE
EMT	ELECTRICAL METALLIC TUBING
FACP	FIRE ALARM CONTROL PANEL
F	FACSIMILE (FAX)
LAN	LOCAL AREA NETWORK
MER	MAIN EQUIPMENT ROOM
NEC	NATIONAL ELECTRIC CODE
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OFE	OWNER FURNISHED EQUIPMENT
PA	PUBLIC ADDRESS
PBX	PRIVATE BRANCH EXCHANGE
PC	PERSONAL COMPUTER
PoE	POWER OVER ETHERNET
PP	PATCH PANEL
PVC	POLYVINYL CHLORIDE CONDUIT
QYT	QUANTITY
STP	SHIELDED TWISTED PAIR
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TGB	TELECOMMUNICATIONS GROUNDING BUSSBAR
TIA	TELECOMMUNICATIONS INDUSTRY ASSOCIATION
TMGB	TELECOMMUNICATIONS MAIN GROUNDING BUSSBAR
TR	TELECOMMUNICATIONS ROOM
TV	TELEVISION
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR
VGA	VIDEO GRAPHICS ARRAY
VoIP	VOICE OVER INTERNET PROTOCOL
W	WALL TELEPHONE (VOICE)
WAN	WIDE AREA NETWORK
WG	WIRE GUARD
WP	WEATHERPROOF

TECHNOLOGY SYMBOL LEGEND (NOT ALL MAY BE USED)

DB	DURESS BUTTON SENTROL UL RATED #3050; 4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, 1/2" FLEXIBLE CONDUIT, (2) #18 - 6C CABLE. MOUNT DEVICE BELOW DESK, REFER TO DETAILS FOR ADDITIONAL INFORMATION. COORDINATE WITH FURNITURE INSTALLATION		WALL MOUNTED - FIXED DOME CAMERA; MOUNT AS NOTED, CAT 6A - 5FT LONG PATCH CORD / CABLE, "WP" EXTERIOR MOUNTED WEATHERPROOF CAMERA	S	PA HORN SPEAKER; 2G 2.5" DEEP BACK BOX, 3/4" CONDUIT, PLENUM RATED CABLE (A/R). SECURE HORNS TO STRUCTURE, EXTERIOR HORNS SHALL RECEIVE PROPER WEATHERPROOFING ASSEMBLY	AP	CEILING MOUNTED WIRELESS ACCESS POINT; HUBBELL #HSB2WP SURFACE MOUNTED PLENUM BOX, (2) CAT 6A SHIELDED PLENUM CABLE, (2) 8P8C (RJ45) JACK - CAT 6A SHIELDED. CEILING MOUNTED AP SHALL HAVE A 15FT SERVICE LOOP LOCATED AT APPROXIMATE LOCATIONS SHOWN ON PLANS.	W	WALL PHONE OUTLET; MOUNT 48" AFF (UON) W/1-GANG 2.5" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (1) CAT 6A PLENUM CABLE, 8P8C (RJ45) JACK - CAT 6A & WALL PHONE MOUNTING PLATE
LD	EMERGENCY LOCK DOWN BUTTON; MOUNT 48" AFF (UON), 1G - 2.5" DEEP BACK BOX, 3/4" CONDUIT, (2) #18 - 6C CABLE. STI BOX SHALL BE GREEN - CUSTOM LABEL "LOCKDOWN", CONFIRM LOCATION WITH CONSULTANT PRIOR TO INSTALLATION	XX	MULTI-VIEW - FIXED DOME CAMERA; MOUNT AS NOTED, CAT 6A - 5FT LONG PATCH CORD / CABLE, "XX" INDICATES TYPE OF VIEW (DV - DUAL VIEW, 3V - THREE VIEW, QV - QUAD VIEW, ETC.)	R	PA STROBE LIGHT FIXTURE; MOUNT 108" AFF, 2G 2.5" DEEP BACK BOX, 1G - DEVICE RING, 3/4" CONDUIT, PLENUM RATED CABLE (A/R).	AP	WALL MOUNTED WIRELESS ACCESS POINT; W/1-G 2.5" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, HUBBELL #HSB2WP SURFACE MOUNTED PLENUM BOX, (2) CAT 6A SHIELDED PLENUM CABLE, (2) 8P8C (RJ45) JACK - CAT 6A SHIELDED.	1D	1 DATA OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (1) CAT 6A PLENUM CABLE, 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
DR	DOOR RELEASE BUTTON - DORTRONICS #5276-HD29 1G, FSR #DSKB_385 TABLE BOX; 1G - 2.5" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, 1/2" FLEXIBLE CONDUIT, SURFACE MOUNTED BOX, #22 - 4C CABLE. (2) #18 - 6C CABLE. MOUNT SWITCH TO TABLE BOX, LABEL SWITCH "DOOR # PUSH TO RELEASE". LABEL SHALL BE ENGRAVED, CONFIRM LOCATION ON DESK W/OWNER & FURNITURE CONT.	CR	ACCESS CONTROL CARD READER (HID MULTICLASS SE #RP10 OR SE #RP40); MOUNT 46" AFF (UON), 4" x 4" x 2.125" DEEP BACK BOX, #18 - 6C SHIELDED CABLE	PS	PENDANT MOUNTED PA SPEAKER; 2G 2.5" DEEP BACK BOX, 3/4" CONDUIT, PLENUM RATED CABLE (A/R)	H	WALL MOUNTED CLOCK; MOUNT 96" AFF (UON) W/1-GANG 2.5" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (1) CAT 6A PLENUM CABLE, 8P8C (RJ45) JACK - CAT 6A & FACEPLATE - DATA	2D	2 DATA OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (2) CAT 6A PLENUM CABLE, (2) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
SBE	BLUE SECURITY STROBE - EXTERIOR; MOUNT AS NOTED, 1G - 2.5" DEEP BACK BOX, 3/4" CONDUIT, PLENUM CABLE (A/R). COORDINATE 120V POWER WITH ELECTRICIAN, REFER TO DETAILS AND WIRING DIAGRAMS FOR ADDITIONAL INFORMATION	DC	DOOR CONTACT / POSITION SWITCH; 1/2" FLEXIBLE CONDUIT, #22 - 4C CABLE. DPS SHALL BE DPDT SHOWN ON THESE PLANS FOR FINAL CABLING CONNECTIONS		CLOCK - ALL CLOCKS ARE 12" DIAMETER. CLOCKS NOTED AS 16 ARE TO BE 16" DIAMETER CLOCKS; MOUNT 96" AFF (UON). REFER TO ARCHITECTURAL PLANS FOR MOUNTING HEIGHT	MON	MONITOR OUTLET; MOUNT 60" AFF (UON) W/LEGRAND #EFSB44G WALL BOX,1G DEVICE RING, 1" CONDUIT, (2) CAT 6A PLENUM CABLE, (2) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA	3D	3 DATA OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (3) CAT 6A PLENUM CABLE, (3) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
SBI	BLUE SECURITY STROBE - INTERIOR; MOUNT AS NOTED, 1G - 2.5" DEEP BACK BOX, 3/4" CONDUIT, PLENUM CABLE (A/R). COORDINATE 120V POWER WITH ELECTRICIAN, REFER TO DETAILS AND WIRING DIAGRAMS FOR ADDITIONAL INFORMATION	JB	JUNCTION BOX; 4" x 4" x 2.125" DEEP BACK BOX, 1" CONDUIT, 1/2" FLEXIBLE CONDUIT (A/R), BELDEN #6358AFJ COMPOSITE CABLE OR EQUAL (18-6C SHIELDED, 22-2C, 22-4C & 18-4C)		COMBINATION CLOCK & SPEAKER - ALL CLOCKS AND SPEAKERS ARE 12" DIAMETER (UON); MOUNT 96" AFF (UON). REFER TO ARCHITECTURAL PLANS FOR MOUNTING HEIGHT			4D	4 DATA OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (4) CAT 6A PLENUM CABLE, (4) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
REX	INTERNAL REQUEST TO EXIT SWITCH; 1/2" FLEXIBLE CONDUIT, #22 - 4C CABLE. SPECIFIED IN DIV. 08 0671, SHOWN ON THESE PLANS FOR FINAL CABLING CONNECTIONS.	EL STK	ELECTRIC DOOR HARDWARE (LOCK / STRIKE); #18 - 4C CABLE. SPECIFIED IN DIV. 08, DPS SHALL BE DPDT SHOWN ON THESE PLANS FOR FINAL CABLING CONNECTIONS			S VC	CEILING MOUNTED PA SPEAKER W/BUILT-IN VOLUME CONTROLS, PLENUM RATED CABLE (A/R). VERIFY COLOR WITH ARCHITECT	1V1D	1 VOICE - 1 DATA OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (2) CAT 6A PLENUM CABLE, (2) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
AB	ALERTUS ALERT BEACON; MOUNT 60" AFF, 4" x 4" x 2.125" DEEP BACK BOX, 3/4" CONDUIT, CAT 6A - CABLE TO NETWORK, PLENUM CABLE (A/R). COORDINATE MOUNTING HEIGHT OF ALARM W/OWNER PRIOR TO ROUGH-IN. DURESS BUTTONS AND LOCKDOWN BUTTON SHALL TIE TO ALERT BEACON. BEACON TO TIE TO LAN, SEE WIRING DIAGRAM	ICD	VIDEO INTERCOM DOOR STATION; MOUNT 46" AFF, 4" x 4" x 2.125" DEEP BACK BOX, 1" CONDUIT, CAT 6A - CABLE TO NETWORK, PLENUM CABLE (A/R). INTERCOM DOOR RELEASE SHALL RELEASE LOCKED DOOR FROM THE ACCESS CONTROL PANEL	H D	INTERACTIVE DISPLAY / SMARTBOARD; MOUNT 60" AFF (UON), (2) 1.25" CONDUITS AND CHIEF #PAC525FCW BACK BOX	S	CEILING MOUNTED PA SPEAKER - 8" DIAMETER, PLENUM RATED CABLE (A/R). VERIFY COLOR WITH ARCHITECT	1V2D	1 VOICE - 2 DATA OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (3) CAT 6A PLENUM CABLE, (3) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
MP	LOCAL DOOR ALARM REMOTE MONITORING PLATE; 4" x 4" x 2.125" DEEP BACK BOX, 3/4" CONDUIT, PLENUM CABLE (A/R). COORDINATE MOUNTING HEIGHT WITH OWNER PRIOR TO ROUGH-IN. REFER TO SECURITY DETAILS FOR ADDITIONAL INFORMATION	ICM	VIDEO MASTER STATION - INTERCOM - DOOR RELEASE; CAT 6A - CABLE TO NETWORK. CONTRACTOR TO CONFIRM ROUTING OF ICD'S TO ICM AND ROLLOVER FROM THE OWNER PRIOR TO CONFIGURATION.	A	AV INTERFACE BACKBOX - INPUT END; MOUNT 18" AFF (UON) W/4" x 4" x 4" DEEP BACK BOX, 2G DEVICE RING, (2) 1.25" CONDUIT	S 2x2	CEILING MOUNTED CLASSROOM SPEAKER - 2' X 2' TILE TYPE, PLENUM RATED CABLE (A/R)	2V2D	2 VOICE - 2 DATA OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (4) CAT 6A PLENUM CABLE, (4) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
						S	WALL MOUNTED BOX SPEAKER; 2G 2.5" DEEP WALL BOX, 3/4" CONDUIT & PLENUM RATED CABLE (A/R)		
		K	INTRUSION DETECTION KEYPAD; MOUNT 48" AFF, 4" x 4" x 2.125" DEEP BACK BOX, 3/4" CONDUIT, #18 - 6C SHIELDED CABLE.	A1	AV INTERFACE BACKBOX - DEVICE END; MOUNT 60" AFF (UON), (2) 1.25" CONDUITS AND CHIEF #PAC525FCW BACK BOX	VC	PA VOLUME CONTROL; MOUNT 48" AFF (UON) W/2G 2.5" DEEP BACK BOX, 1G DEVICE RING, 3/4" CONDUIT, PLENUM RATED CABLE (A/R). VOLUME CONTROL SHALL CONTROL THE SPEAKERS SHOWN WITHIN THE SAME ROOM, CONFIRM COLOR WITH ARCHITECT.	1V	1 VOICE OUTLET; MOUNT 18" AFF (UON) W/4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT, (1) CAT 6A PLENUM CABLE, (1) 8P8C (RJ45) JACK - CAT 6A & 1 FACEPLATE - DATA
				B	AV CONTROL PANEL; MOUNT 48" AFF (UON), 4" x 4" x 4" DEEP WALL BOX, 2G DEVICE RING, 1" CONDUIT				
		M	CEILING MOUNTED, MOTION SENSOR - 360 DEGREE; 4" x 4" x 2.125" DEEP BACK BOX, 3/4" CONDUIT, #18 - 6C CABLE.			PA	PA MASTER HANDSET (BOGEN #MCDS4); PLENUM RATED CABLE (A/R), INCLUDE CABLING (A/R). DATA JACK & FACEPLATE FOR CABLING.	#V #D	FLOOR OUTLET; CONDUIT (A/R), CAT 6A PLENUM CABLE (A/R), 8P8C (RJ45) JACK - CAT 6A (A/R) & FACEPLATE (A/R). REFER TO ELECTRICAL DRAWINGS FOR FLOOR BOX CONDUIT REQUIREMENTS. # - DENOTES QUANTITY OF CABLES
		M	CORNER / WALL MOUNTED, MOTION SENSOR; MOUNT 108" AFF (UON), 4" x 4" x 2.125" DEEP BACK BOX, 3/4" CONDUIT, #18 - 6C CABLE.			CS	PA CALL SWITCH; MOUNT 48" AFF (UON) W/2G 2.5" DEEP BACK BOX, 1G DEVICE RING, 3/4" CONDUIT, PLENUM RATED CABLE (A/R). CS SHALL ACTIVATE 2-WAY CONVERSATION BETWEEN CLASSROOM SPEAKERS AND MAIN OFFICE, CABLING (A/R).	#V #D	CEILING OUTLET; (1) 4" x 4" x 2.125" DEEP BACK BOX, 1G DEVICE RING, 1" CONDUIT (A/R), CAT 6A PLENUM CABLE (A/R), 8P8C (RJ45) JACK - CAT 6A (A/R) & 1 FACEPLATE. CEILING MOUNTED DEVICES, # - DENOTES QUANTITY OF CABLES
					CEILING MOUNTED - INTERIOR FIXED DOME CAMERA; CAT 6A - 5FT LONG PATCH CORD / CABLE				

Project Title:

GREENWICH PUBLIC SCHOOLS - EASTERN MIDDLE SCHOOL
SECURE ENTRANCE
51 HENDRIE AVE.
RIVERSIDE, CT 06878

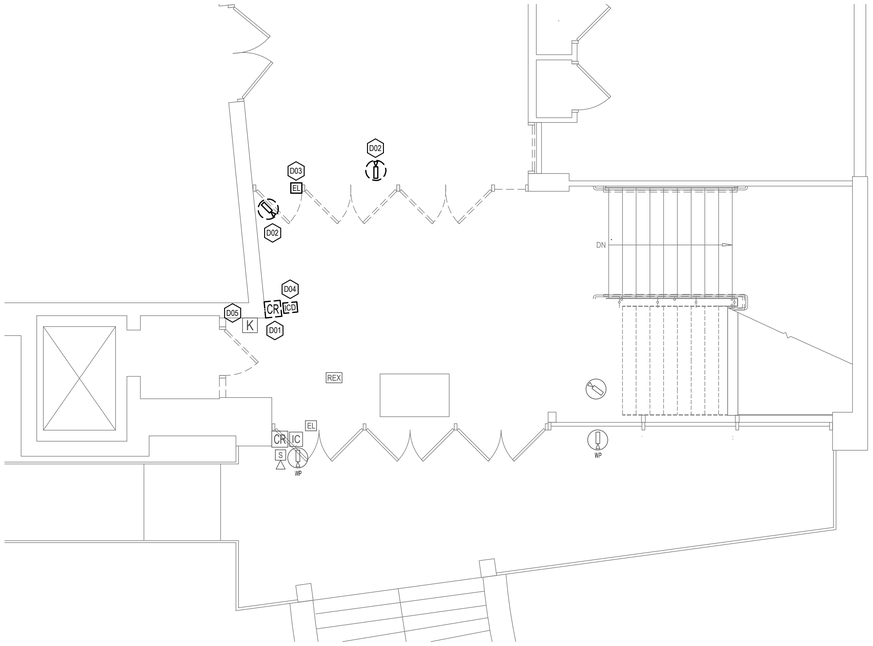
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Revision:	Description:	Date:	Revised By:

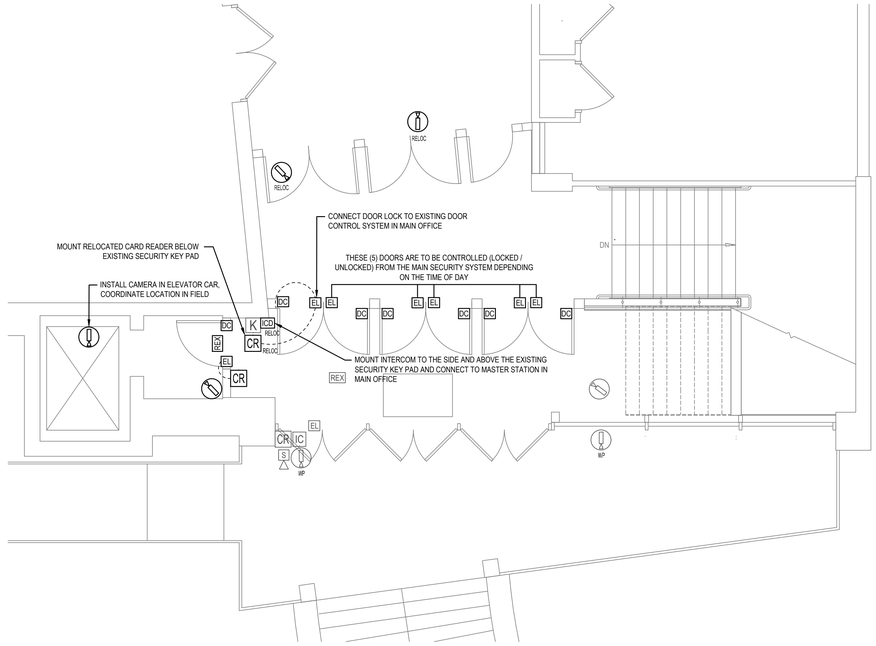
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Project Phase: ISSUED FOR BID
State Project Number: N/A

Date: 11/10/2026
Scale: AS NOTED
Drawn By: S. CROTEAU
Project Number: 24-179

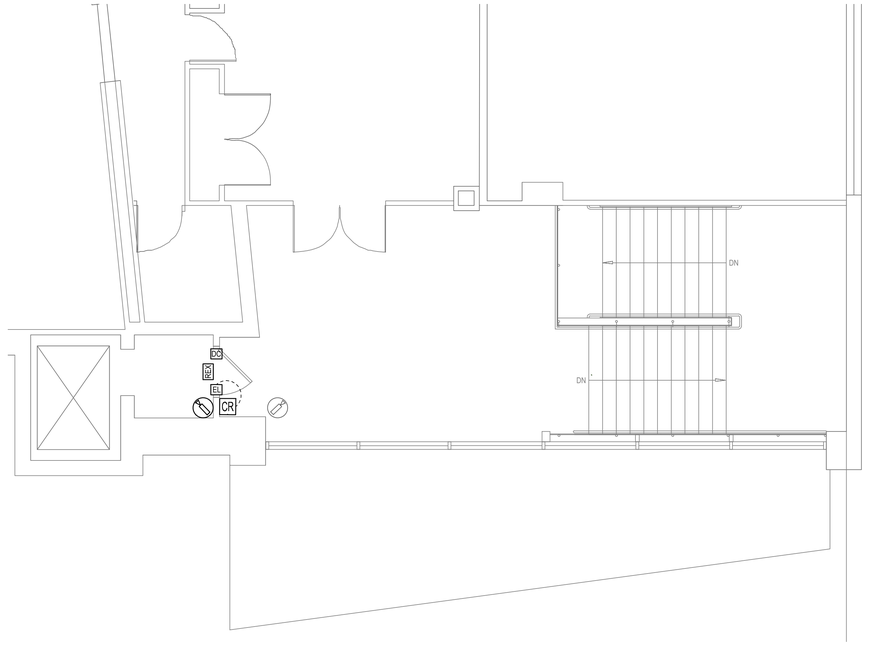
Drawing Number: T001



1 PARTIAL FIRST FLOOR DEMOLITION PLAN
1/4"=1'-0"



2 PARTIAL FIRST FLOOR PLAN
1/4"=1'-0"



3 PARTIAL SECOND FLOOR PLAN
1/4"=1'-0"

GENERAL DEMOLITION NOTES

1. REFER TO DRAWING T001 FOR SYMBOLS AND ABBREVIATIONS AND GENERAL NOTES.
2. ALL WORK SHALL CONFORM WITH THE TECHNOLOGY SPECIFICATIONS AND THE LATEST ACCEPTED NATIONAL ELECTRICAL CODE (NEC).
3. ALL EXISTING DEVICES (CARD READERS, CAMERAS, INTERCOM, SPEAKERS, ETC.) SHOWN DARK AND DASHED OR SOLID ARE TO BE REMOVED UNLESS OTHERWISE NOTED. ALL EXISTING DEVICES SHOWN SOLID AND HALF-TONE (LIGHT), ARE EXISTING TO REMAIN AND ALL WIRING TO THESE DEVICES SHALL REMAIN WIRED TO THEIR EXISTING SYSTEMS. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE CONTINUITY OF ALL EXISTING WIRING AFFECTED BY THE RENOVATION AND PROVIDE ADDITIONAL WIRING AS NEEDED.
4. ALL SECURITY WORK (NEW & RELOCATIONS) SHALL BE COORDINATED WITH GREENWICH PUBLIC SCHOOL SECURITY DIRECTOR AND THE CITY'S SECURITY VENDOR (SECURITY SPECIALIST), INCLUDING BUT NOT LIMITED TO CAMERAS/CARD READERS/DOOR CONTACTS/VIDEO INTERCOMS/CABLING/ETC. COORDINATE REQUIREMENTS TO INTERFACE THE ELECTRIC LOCKS WITH SECURITY SYSTEM WITH THE DOOR HARDWARE VENDOR (ASSA ABLOY). WIRING FOR ALL NEW SECURITY DEVICES SHALL BE RUN TO LOCAL IT CLOSET.

DEMOLITION KEY NOTES

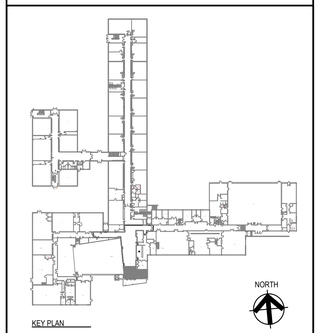
D01 CONTRACTOR SHALL DISCONNECT, REMOVE AND RELOCATE EXISTING CARD READER INDICATED (SHOWN DARK & SOLID). EXISTING WIRING SHALL BE REMOVED FROM DEVICE AND COILED UP AND SUPPORTED ABOVE CEILING TO BE USED TO SERVE RELOCATED DEVICE. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED DEVICE.

D02 CONTRACTOR SHALL DISCONNECT, REMOVE AND RELOCATE EXISTING CEILING MOUNTED SECURITY CAMERA INDICATED. EXISTING WIRING SHALL BE REMOVED FROM DEVICE AND COILED UP AND SUPPORTED ABOVE CEILING TO BE USED TO SERVE RELOCATED DEVICE. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED DEVICE.

D03 CONTRACTOR SHALL DISCONNECT AND REMOVE WIRING TO EXISTING LOCK AT DOOR TO BE REMOVED AND COILED UP AND SUPPORTED ABOVE CEILING TO SERVE NEW DOOR IN THIS AREA. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED DEVICE.

D04 CONTRACTOR SHALL DISCONNECT, REMOVE AND RELOCATE EXISTING WALL MOUNTED VIDEO INTERCOM DOOR STATION INDICATED (SHOWN DARK & SOLID). EXISTING WIRING SHALL BE REMOVED FROM DEVICE AND COILED UP AND SUPPORTED ABOVE CEILING TO BE USED TO SERVE RELOCATED DEVICE. REFER TO NEW WORK PLAN FOR LOCATION OF RELOCATED DEVICE.

D05 CONTRACTOR SHALL DISCONNECT, REMOVE AND RELOCATE EXISTING SURFACE MOUNTED RACEWAY AND ASSOCIATED WIRING TO THE ADJACENT SECURITY KEY PAD THAT RUNS ON THE WALL OF THE ELEVATOR VESTIBULE THAT IS TO BE REMOVED. REINSTALL RACEWAY AND WIRING ON THE SAME WALL AS THE KEY PAD IN THE CORNER NEAR THE NEW WALL.



KEY PLAN

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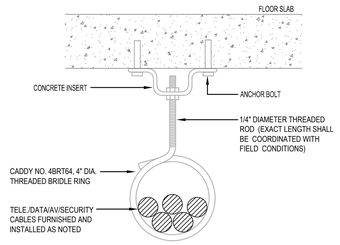
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Revision:	Description:	Date:	Revised By:

Drawing Title: PARTIAL FIRST & SECOND FLOOR PLANS - TECHNOLOGY
Project Phase: ISSUED FOR BID
State Project Number: N/A

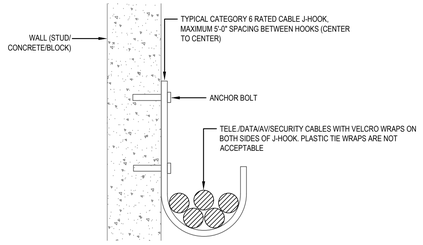
Date: 11/10/2026
Scale: AS NOTED
Drawn By: S. CROTEAU
Project Number: 24-179

Drawing Number: T100



1 CABLE RING DETAIL

NOT TO SCALE

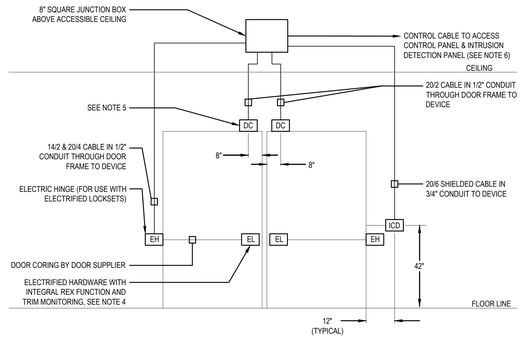


NOTES:

1. J-HOOKS SHALL BE SIZED TO ACCOMMODATE TWICE AS MANY CABLES REQUIRED TO BE SUPPORTED INCLUDING AN ADDITIONAL 40% HEADROOM.

2 J-HOOK DETAIL

NOT TO SCALE

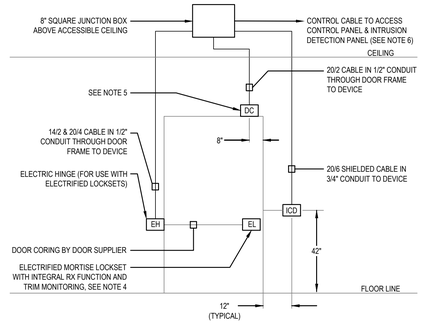


NOTES

1. TYPICAL DOUBLE DOOR SHOWN. SEE ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR DOOR/FRAME DETAILS AND HARDWARE SETS.
2. COORDINATE ELECTRICAL HARDWARE REQUIREMENTS WITH HARDWARE SUPPLIER.
3. COORDINATE WIRING THROUGH FRAMES WITH DOOR AND FRAME INSTALLATION.
4. REQUEST TO EXIT (REX) DEVICE INTEGRAL TO HARDWARE. ELECTRIC HINGE/POWER TRANSFER DEVICE AND WIRING HARNESSES PROVIDED WITH HARDWARE. COORDINATE CONNECTIONS WITH HARDWARE INSTALLATION.
5. RECESSED MAGNETIC CONTACTS. COORDINATE WITH FRAME INSTALLATION. PROVIDE DPDT DOOR CONTACTS FOR CONNECTION TO ACCESS CONTROL SYSTEM
6. WIRING TO ACCESS CONTROL PANEL, INTRUSION DETECTION PANEL & CAT 6 TO PATCH PANEL ABOVE ACCESSIBLE CEILINGS MAY BE INSTALLED SUPPORTED BY J-HOOKS. ALL WIRING SHALL BE PLENUM RATED.
7. COORDINATE WIRING THROUGH HOLLOW METAL FRAMES WITH THE FRAME INSTALLATION. WHERE CALLED FOR TO WIRE DEVICES "THROUGH THE FRAME IN CONDUIT", LOOSE WIRING IN THE FRAME CHANNELS IS ACCEPTABLE.
8. COORDINATE EXACT LOCATION OF INTERCOM/CARD READER WITH FIELD CONDITIONS AND ARCHITECTURAL ELEVATIONS PRIOR TO INSTALLATION.
9. SEE MANUFACTURER'S JOB SPECIFIC WIRING DIAGRAMS FOR ADDITIONAL INFORMATION.

3 DOUBLE DOOR CARD/INTERCOM WIRING DETAIL

NOT TO SCALE

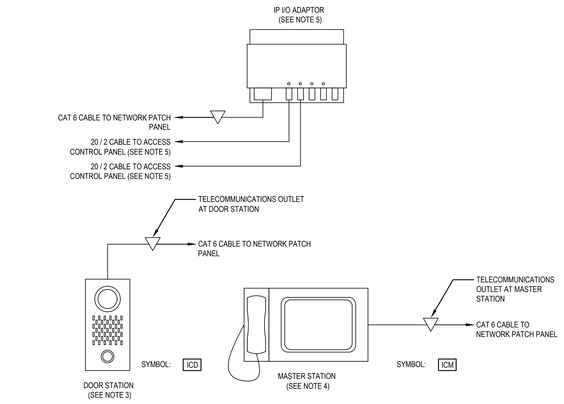


NOTES:

1. TYPICAL SINGLE DOOR SHOWN. SEE ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR DOOR/FRAME DETAILS AND HARDWARE SETS.
2. COORDINATE ELECTRICAL HARDWARE REQUIREMENTS WITH HARDWARE SUPPLIER.
3. COORDINATE WIRING THROUGH FRAMES WITH DOOR AND FRAME INSTALLATION.
4. REQUEST TO EXIT (REX) DEVICE INTEGRAL TO HARDWARE. ELECTRIC HINGE/POWER TRANSFER DEVICE AND WIRING HARNESSES PROVIDED WITH HARDWARE. COORDINATE CONNECTIONS WITH HARDWARE INSTALLATION.
5. RECESSED MAGNETIC CONTACTS. COORDINATE WITH FRAME INSTALLATION. PROVIDE DPDT DOOR CONTACTS FOR CONNECTION TO ACCESS CONTROL SYSTEM
6. WIRING TO ACCESS CONTROL PANEL, INTRUSION DETECTION PANEL & CAT 6 TO PATCH PANEL ABOVE ACCESSIBLE CEILINGS MAY BE INSTALLED SUPPORTED BY J-HOOKS. ALL WIRING SHALL BE PLENUM RATED.
7. COORDINATE WIRING THROUGH HOLLOW METAL FRAMES WITH THE FRAME INSTALLATION. WHERE CALLED FOR TO WIRE DEVICES "THROUGH THE FRAME IN CONDUIT", LOOSE WIRING IN THE FRAME CHANNELS IS ACCEPTABLE.
8. COORDINATE EXACT LOCATION OF INTERCOM/CARD READER WITH FIELD CONDITIONS AND ARCHITECTURAL ELEVATIONS PRIOR TO INSTALLATION.
9. SEE MANUFACTURER'S JOB SPECIFIC WIRING DIAGRAMS FOR ADDITIONAL INFORMATION.

4 SINGLE DOOR CARD/INTERCOM WIRING DETAIL

NOT TO SCALE



NOTES:

1. TYPICAL REQUIREMENTS SHOWN. REFER TO DRAWINGS FOR LOCATIONS AND TYPES OF DEVICES.
2. INTERCOM DOOR STATIONS TO REPORT TO MASTER STATION LOCATED IN MAIN OFFICE.
   A. DOOR STATION AT MAIN ENTRANCE - MASTER STATION AT WATCH ROOM.
3. COORDINATE EXACT MOUNTING HEIGHT AND LOCATION OF DOOR STATIONS WITH ARCHITECTURAL ELEVATIONS.
4. MASTER STATION IS EXISTING IN MAIN OFFICE, COORDINATE LOCATION IN THE FIELD.
5. SELECTIVE DOOR RELEASE RELAYS ARE PROGRAMMABLE TO RESPOND TO INCOMING DOOR STATION WHEN DOOR RELEASE IS ACTIVATED AT THE MASTER STATION. FUNCTION IS SPECIFIC TO THE DOOR STATION. TYPICAL INTERCONNECTION BETWEEN INTERCOM DOOR RELEASE RELAY AND ACCESS CONTROL SYSTEM SHOWN, PROVIDE RELAYS AS REQUIRED FOR SELECTIVE DOOR RELEASE AT ACCESS CONTROL PANELS. MOUNT RELAY IN SUITABLE NEMA 1 ENCLOSURE AT ACCESS CONTROL PANEL.

5 IP-BASED VIDEO INTERCOM SYSTEM DETAIL

NOT TO SCALE

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Revision:	Description:	Date:	Revised By:

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Scale: AS NOTED
Drawn By: S. CROTEAU
Project Number: 24-179
Drawing Number: T600