EAST PROVIDENCE
SCHOOL DEPARTMENT

RIVERSIDE MIDDLE SCHOOL
EAST PROVIDENCE, RHODE ISLAND

WINDOW REPLACEMENT PROJECT

Project Manual

PREPARED BY:

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DECEMBER 30, 2022
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SECTION 00 10 00
SOLICITATION

1.0 SOLICITATION INFORMATION

Schedule

Bid Documents:
All bid documents may be obtained at the East Providence School District Director of Finance Office City Hall, East Providence, RI between 8am and 4pm Monday through Friday beginning on December 30, 2022, or by email request to jspokis@jensenhughes.com.

Pre-Bid Conference:
A pre-bid conference will be held commencing at 3:00 PM on Thursday, January 12, 2023, at Riverside Middle School, 179 Forbes Street, Riverside, RI. Attendance is strongly encouraged as this will be bidders’ opportunity to visit and familiarize themselves with the facility where they will be providing services, so that they may respond accurately to this RFP.

RFP Submission Deadline:
Thursday, February 9, 2023, at 10:00AM. Late submittals will be immediately disqualified.

Requests for Information:
Requests for Information during the Bidding Period will be accepted until 5:00 p.m. on Tuesday, January 24, 2023.

Requests for information or clarification must be made electronically to the attention of jspokis@jensenhughes.com.

Answers to RFI’s received, will be forwarded electronically to all bidders who have registered and obtained a set of bid documents.

Proposals must be mailed or hand-delivered in a sealed envelope marked as follows:

Marked as:

East Providence School Department
Riverside Middle School Window Replacement

To:

Craig Enos
East Providence School District – Director of Finance
1998 Pawtucket Avenue
East Providence, RI 02914
Bonds
A Bid Bond in the amount of 5% of the bid must accompany each bid. Checks for Bid Security will not be accepted in lieu of a Bid Bond.

A 100% Payment and Performance Bond will be required by the awarded bidder along with all insurance documentation as required by the East Providence School Department.

Miscellaneous
The bid process and resulting contract are subject to the Rules and Regulations and General Terms and Conditions of Purchase. Submission of a bid in response to this solicitation is acknowledgement and acceptance of these Rules and Regulations and General Terms and Conditions of Purchase.

The East Providence School Department reserves the right to award on the basis of cost alone, accept or reject any or all bids, and to act in its best interest. Proposals found to be technically or substantially non-responsive at any point in the evaluation process will be rejected and not considered further. The East Providence School Department may, at its sole option, elect to require presentations(s) by bidders clearly in consideration for award.

2.0 BIDDER INSTRUCTIONS

It is the bidder's responsibility to examine all specifications and conditions thoroughly and comply fully with specifications and all attached terms and conditions. Bidders must comply with all Federal, State, and City laws, ordinances and regulations, and meet any and all registration requirements where required for contractors as set forth by the State of Rhode Island. Failure to make a complete submission as described herein may result in a rejection of the proposal.

All costs associated with developing or submitting a proposal in response to this Request, or to provide oral or written clarification of its content shall be borne by the bidder. The East Providence School Department assumes no responsibility for these costs.

Proposals are considered to be irrevocable for a period of not less than thirty (30) days following the opening date, and may not be withdrawn, except with the express written permission of the Director of Finance. Should any bidder object to this condition, the bidder must provide objection through a question and/or complaint to the Director of Finance prior to the proposal deadline.

All pricing submitted will be considered to be firm and fixed unless otherwise indicated herein.

The bidder has full responsibility to ensure that the proposal arrives at the stated bid location prior to the deadline set out herein. The East Providence School Department assumes no responsibility for delays caused by the U.S. Postal Service or any other delivery service.

Postmarking by the due date will not substitute for actual receipt of response by the due date. Proposals arriving after the deadline may be returned, unopened, to the bidder, or may simply be declared non-responsive and not subject to evaluation, at the sole discretion of the East Providence School Department. For the purposes of this requirement, the official time and date shall be that of the clock in the Office of the City Manager’s administrative area.

It is intended that an award pursuant to this Request will be made to a prime contractor, who will assume responsibility for all aspects of the work. Joint venture and cooperative proposals will not be considered, but subcontractors are permitted, provided that their use is clearly indicated in the bidder’s proposal, and the subcontractor(s) proposed to be used are identified in the proposal.

Bidders are advised that all materials submitted to the East Providence School Department for consideration in response to this Request for Proposals shall be considered to be public records as defined in Title 38 Chapter 2 of the Rhode Island General Laws, without exception, and may be released for
inspection immediately upon request once an award has been made.

Bidders are responsible for errors and omissions in their proposals. No such error or omission shall diminish the bidder's obligations to the East Providence School Department.

The East Providence School Department reserves the right to reject any or all proposals, or portions thereof, at any time, with no penalty. The East Providence School Department also has the right to waive immaterial defects, minor irregularities and formalities in any submitted proposal at its sole discretion. All material submitted in response to this RFP shall become the property of the East Providence School Department upon delivery to the stated bid submission location.

There will be a public bid opening immediately following the submission deadline.

3.0 OVERVIEW

The Owner (East Providence School Department) through its Owner's Project Manager (Jensen Hughes) are soliciting bids for the Riverside Middle School Window Replacement.

The Bid Documents, consisting of the Project Manual along with the Plans and Specifications prepared by Jensen Hughes comprises the bidding and construction documentation for this project. This Invitation to Bid provides an overview of the bidding process and logistics for this project.

4.0 SCOPE OF WORK

The complete scope of work is indicated on the bid drawings and specifications. The following information includes the project team:

Project:

East Providence School Department
Riverside Middle School Window Replacement

Owner:

East Providence School Department
1998 Pawtucket Avenue
East Providence, RI 02914

Project Manager:

Jensen Hughes
117 Metro Center Boulevard, Suite 1002
Warwick, RI 02886

Schedule

The contract will be awarded in February 2023 with submittal preparation, approval and materials acquisition to happen immediately thereafter. Onsite work can also start immediately upon contract award following acquisition of appropriate permits and approvals. Substantial completion is required to be achieved by August 16, 2024. Final completion is required to be achieved by September 27, 2024. Liquidated damages will be applicable for failure by the contractor to meet the substantial completion date

Jensen Hughes
StudioJAED Architects & Engineers
00 10 00 - 3
SOLICITATION
of August 16, 2024, and/or the final completion date of September 27, 2024. Liquidated damages will be assessed in the amount of $2,000 per day.

All parking, storage and logistic items for construction will be confined to the construction areas as shown on the Bid Documents or as otherwise agreed to between the successful bidder and the East Providence School Department. Smoking on School grounds is prohibited and failure to conform to this requirement will result in removal from the Project.

Bid Document Availability
Project Documents will be made available in electronic format through USB drives issued by the East Providence School Department.

Prevailing Wage
Local wage rates apply to this project. It is the responsibility of the Contractor before bid openings to request, if necessary, any additional information on local Wage Rates for those tradespeople who are not covered by the applicable local Wage Decision, but who may be employed for the proposed work under this Contract. The Contractor shall obtain the latest wage rates as issued by the Department of Labor and Training.

Collaborative for High Performance Schools
The Collaborative for High Performance Schools (CHPS) criteria will be implemented on the project. CHPS is a leading national movement with the goal of making schools better places to learn. CHPS’ mission is to facilitate the design, construction and operation of high-performance schools: environments that are not only energy and resource efficient, but also healthy, comfortable, well lit, and containing the amenities needed for a quality education. The selected contractor shall provide all material and perform all work so as to adhere to the guidelines of the CHPS program and provide the necessary submittals and other documentation required for the project to achieve CHPS certification.

Form of Contract
A lump sum contract (see attached sample contract) will be executed with the successful bidder for the construction of the entire project. The sample contract included in the bid documents will be utilized. No exception to the scope of work or contract will be considered unless such notification is given before the bid due date and within the Bid Submission.

5.0 PROJECT REQUIREMENTS & CONDITIONS
Contractors shall not order any equipment and shall not begin any work until submittals have been reviewed to the satisfaction of Jensen Hughes. Contractors shall not perform any installation prior to the receipt of a written authority to proceed from Jensen Hughes and receipt of a written permit to proceed by the East Providence Building/Fire Department. Initial payment shall not be made until the “Pre-Installation Documentation” submittal process has been completed.

Jensen Hughes shall review these documents for the limited purposes of checking for general conformance with the design and not to determine accuracy or completeness of other details such as dimensions and quantities. Jensen Hughes shall not approve means, methods or procedures of construction or installation; nor shall they review for safety precautions.

In the event that the Contractor’s submittal package is required to be revised and re-submitted more than once due to nonconformance with this specification, illegibility of the submittal, incomplete submittals,
noncompliance with the referenced local, state and national Codes, Standards and Regulations or nonconformance with pertinent documentation relative to the project, the Contractor may be held responsible for fees associated with additional engineering review services.

6.0 INSURANCE

The vendor shall maintain and keep in force such comprehensive general liability insurance as shall protect them from claims which may arise from operations under any contract entered into with the East Providence School Department, whether such operations be by themselves or by anyone directly or indirectly employed by them.

The amounts of insurance shall be not less than $1,000,000.00 combined single limit for any one occurrence covering both bodily injury and property damage, including accidental death.

The East Providence School Department, City of East Providence and Jensen Hughes shall be named as additional insured on the vendor's General Liability Policy.

The vendor shall maintain and keep in force such Workers' compensation insurance limits as required by the statutes of the State of Rhode Island, and Employer's Liability with limits no less than $500,000.

7.0 ACKNOWLEDGEMENT OF RISK AND HOLD HARMLESS AGREEMENT

In addition to the indemnity provisions specified in the Contract Documents and to the fullest extent permitted by law, the selected bidder, its officers, agents, servants, employees, parents, subsidiaries, partners, officers, directors, attorneys, insurers, and/or affiliates (Releasers) agree to release, waive, discharge and covenant not to sue the East Providence School Department, City of East Providence, its officers, agents, servants or employees (Releasees) from any and all liability, claims, cross-claims, rights in law or in equity, agreements, promises demands, actions and causes of action whatsoever arising out of or related to any loss, damage, expenses (including without limitation, all legal fees, expenses, interest and penalties) or injury (including death), of any type, kind or nature whatsoever, whether based in contract, tort, warranty, or other legal, statutory, or equitable theory of recovery, which relate to or arise out of the Releasers use of or presence in and/or on East Providence School Department and/or City of East Providence property. The Releasers agree to defend, indemnify and hold harmless the Releasees from (a) any and all claims, loss, liability, damages or costs by any person, firm, corporation or other entity claiming by, through or under Releasers in any capacity whatsoever, including all subrogation claims and/or claims for reimbursement, including any court costs and attorneys fees, that may incur due to Releasers use of or presence in and on East Providence School Department and/or City of East Providence property; and (b) any and all legal actions, including third-party actions, cross-actions, and/or claims for contribution and/or indemnity with respect to any claims by any other persons, entities, parties, which relate to or arise out of Releasers use of or presence in and on East Providence School Department and/or City of East Providence property.

The Releasers acknowledge the risks that may be involved and hazards connected with use of or presence in and on East Providence School Department and/or City of East Providence property but elect to provide services under any contract with the East Providence School Department and/or City of East Providence with full knowledge of such risks. Releasers also acknowledge that any loss, damage, and/or injury sustained by Releasers are not covered by Releasees insurance. Releasers agree to become fully aware of any safety risks involved with the performance of services under any contract with the East Providence School Department and/or City of East Providence and any safety precautions that need to be followed and agree to take all such precautions. The duty to indemnify and/or hold harmless the East Providence School Department and/or City of East Providence shall not be limited by the insurance required by the Contract Documents.
8.0 ADDITIONAL INSURANCE REQUIREMENTS

In addition to the insurance provisions in the Contract Documents, the liability insurance coverage, except Professional Liability, Errors and Omissions or Workers’ Compensation insurance required for performance of a contract with the East Providence School Department and/or City of East Providence shall include the East Providence School Department, City of East Providence, its divisions, officers and employees, the Architect and Project Manager as Additional Insureds but only with respect to the selected bidder’s activities under the contract. The insurance required through a policy or endorsement shall include:

- a Waiver of Subrogation waiving any right to recovery the insurance company may have against the East Providence School Department and/or City of East Providence; and
- a provision that the selected vendor’s insurance coverage shall be primary with respect to any insurance, self-insurance or self-retention maintained by the East Providence School Department and/or City of East Providence and that any insurance, self-insurance or self-retention maintained by the East Providence School Department and/or City of East Providence shall be in excess of the selected vendor’s insurance and shall not contribute.

There shall be no cancellation, material change, potential exhaustion of aggregate limits or non-renewal without thirty (30) days written notice from the selected vendor or its insurer(s) to the East Providence School Department. Any failure to comply with the reporting provision of this clause shall be grounds for immediate termination of the contract with the East Providence School Department and/or City of East Providence.

Insurance coverage required under the contract shall be obtained from insurance companies acceptable to the East Providence School Department. The selected vendor shall pay for all deductibles, self-insured retentions and/or self-insurance included hereunder.

The East Providence School Department reserves the right to consider and accept alternative forms and plans of insurance or to require additional or more extensive coverage for any individual requirement.

9.0 STATE AND FEDERAL TAXES

The City is exempt from the payment of the Rhode Island Sales Tax under the 1956 General Laws of the State of Rhode Island, 44-18-30, Paragraph 1, as amended.

The City is exempt from the payment of any excise tax or federal transportation taxes. The price bid must be exclusive of taxes and will be so construed.

10.0 PROPERTY LOST, DAMAGED OR DESTROYED

Any property or work to be provided by bidder will remain at the bidder’s risk until written acceptance by the East Providence School Department and the bidder will replace, at bidder’s expense, all property or work lost, damaged or destroyed by any cause whatsoever.

11.0 CLOSEOUT

Final payment will not be received by the Contractors until the window installation has been approved by the Local Authority, all miscellaneous “punch list” items are addressed, closeout documentation has been received by the Owner and Owner’s Project Manager.
12.0 PROPOSAL CONTENT AND ORGANIZATION

Pricing must include all costs as specified in this solicitation. Pricing for this proposal must be indicated on the Bid Form in Section 14.0 of this document and must be submitted in a separate, sealed envelope labeled as previously stated above.

All Bid Forms must be signed.

Bidders must include on the Bid Form a list of at least four (4) references with whom they have contracted to do similar work by including the company name, telephone number, contact person, and number of years they have served this customer. Include approximate construction cost of similar work performed for listed references.

Bidders must also include an overview of their company’s experience including, but not limited to, the number of years the company has been providing these services, the size of the company (including the number of employees and locations), a description of work undertaken that is similar to what is being requested in this RFP, and, if applicable, certifications that show a knowledge of equipment that would be serviced or provided under this contract.

If any subcontractors are to be used in the performance of any work contracted for under this RFP, please list their name(s), contractor license #, address and phone number, and specific description of the subcontract work to be performed.

Bidders must include a project schedule highlighting key project milestones and strategy around the completion by the substantial and final completion dates identified in Section 4.0. The proposed project strategy shall describe any construction activities taking place when school is in session and how school interruption/impacts will be limited. Schedule shall account for Work Restrictions identified in Section 0110 00 Summary of Work – 1.7.

Four (4) copies of your proposal, one (1) original and three (3) copies, must be submitted at the time of submission. Proposals must be in the following format:

- Bid Form Company overview
- Length of time your firm has been in business
- Length of time at current address

All licensing (List types and business license number(s)), certification and permits as required in the Scope of Work

Please state any and all additions, deletions, and exceptions, if any, that you are taking to any portion of this proposal. If not addressed specifically, the East Providence School Department assumes that the bidder will adhere to all terms and conditions listed in this RFP.

13.0 PROPOSAL EVALUATION CRITERIA

The evaluation of proposals will be conducted in an expeditious time frame convenient to the East Providence School Department.

The East Providence School Department reserves the right to award on the basis of cost alone, accept or reject any or all proposals, and to otherwise act in its best interest. Further, the East Providence School Department reserves the right to waive irregularities it may deem minor in its consideration of proposals.

Proposals found to be technically or substantially non-responsive at any point in the evaluation process will be rejected and not considered further. The East Providence School Department may elect to require presentations(s) by vendors in consideration for award.
Proposals will be evaluated in two (2) phases:

1. The first phase is an initial review to determine if the proposal, as submitted, is complete. To be complete, a proposal must meet all the requirements of this RFP.

2. The second phase is an in-depth analysis and review based on criteria below and their associated weights. The following detailed criteria will be utilized in the evaluation procedure:

   a. **Relevant Experience, Qualifications and Compliance with bidding requirements**: The bidder should show previous project experience in Rhode Island Educational K-12 facilities as it relates to the scope of work outlined in the bid documents. The bidder should show previous experience related to working in occupied schools during the duration of construction. The previous relevant projects should be of similar scope size and construction cost value. Where applicable, previous project experience for the East Providence School Department should be highlighted. The bidder should provide documentation indicating that all applicable state licenses are in good standing. The bidder should provide the length of time that the organization has been in business as well as any other names that were previously utilized. The bidder should submit a proposed project schedule as well as principals and/or project managers that will be utilized on this project. The bidder should provide M/WBE documentation as outlined in the bid documents. The bidder should provide any additional information that illustrates the ability to perform this scope of work, in accordance with all codes and standards and in the allocated project schedule duration.

   b. **References**: The bidder should provide a minimum of four (4) references that represent clients that the bidder has previously worked with that can attest to the bidder’s work product, professionalism and timeliness. The references provided should represent clients with projects similar scopes and construction values to those listed in the bid documents. References that illustrate the bidder’s experience in educational environments in occupied buildings are strongly encouraged.

   c. **Cost**: The bidder should provide a firm-fixed fee for the scope of work illustrated in the bid documents. The bidder with the low bid while also providing all documents required of the bid documents will receive the full 40% of the cost component. All other bidders will be provided with a pro-rated value for the cost component of the bid evaluation.

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</tr>
<tr>
<td>References</td>
<td>30%</td>
</tr>
<tr>
<td>Cost</td>
<td>40%</td>
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In the event that the East Providence School Department requires further information and/or a demonstration of any equipment or process offered in any proposal, all vendors asked for same will do so at no cost to the East Providence School Department.
14.0 BID FORM

Riverside Middle School Window Replacement Project

Date: ________________________________

Submitted By:
(Include Name, Address and Telephone No.):

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Name and Remittance Address that will appear on Invoices:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Physical Address of Business:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

General Information
Is your firm a sole proprietorship doing business under a different name? _____ Yes _____ No

If yes, please indicate sole proprietorship, a name, and the name you are doing business under.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Is your firm incorporated? _____ Yes _____ No

Will any of the work spelled out in this bid be outsourced? _____ Yes _____ No

If so, please explain below:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Have you or your firm been subject to suspension, debarment or criminal conviction by the East Providence School Department and/or City of East Providence, the State of Rhode Island, or any other jurisdiction?  
Yes:__________  No:__________

Have the East Providence School Department and/or City of East Providence and/or the State of Rhode Island ever terminated contracts with your firm for cause?  
Yes:__________  No:__________

Has your firm ever withdrawn from a contract with the East Providence School Department and/or City of East Providence and/or the State of Rhode Island during its performance?  
Yes:__________  No:__________

Have you or your firm been involved in litigation against the East Providence School Department and/or City of East Providence and/or the State of Rhode Island.  
Yes:__________  No:__________

If you answered yes to any of the foregoing, please explain the circumstances below. If you or your firm has been involved in litigation against the East Providence School Department and/or City of East Providence and/or the State of Rhode Island, please include the case caption, case number and status. (If more space is needed, please attach separate sheet and submit with the bid.)

__________________________________________________________________________

__________________________________________________________________________

Liquidated Damages:

The contractor acknowledges that liquidated damages will be applicable for failure by the contractor to meet the substantial completion date of **August 16, 2024**, and/or the final completion date of **September 27, 2024**. Liquidated damages will be assessed in the amount of $2,000 per day.

Initial: ___________________________

Addenda:

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

Addendum #1, Dated: Pre-Bid RFI Questions dated November 29, 2022

References:

Please list at least four (4) entities with whom you have contracted to provide similar services. Preferably, references should be school departments, municipalities or State agencies or other public work; a website address should be included if available.
Reference #1
Company Name:
Contact Person:
Telephone Number:
Email Address:
Project Contract Dates:

Reference #2
Company Name:
Contact Person:
Telephone Number:
Email Address:
Project Contract Dates:

Reference #3
Company Name:
Contact Person:
Telephone Number:
Email Address:
Project Contract Dates:

Reference #4
Company Name:
Contact Person:
Telephone Number:
Email Address:
Project Contract Dates:
Riverside Middle School Window Replacement Project Proposal

Having examined the reference RFP and its applicable documents, we propose to enter into a contract to perform services per the bid specifications for the costs listed below:

A. BASE BID

Following careful review of the Contract Documents and consisting of Instructions to Bidders, all drawings and specifications, all addenda as specified below, and having examined the site to develop a familiarization with the working conditions, the undersigned proposes to furnish materials and provide labor to perform construction work as indicated with a 100% performance bond to complete the East Providence Schools Riverside Middle School Window Replacement Project for stipulated sums listed below.

Riverside Middle School Window Replacement Project

$ , , , .

Written Proposal Value:

Undersigned agrees above stipulated sum is firm price including applicable taxes and is not subject to extras or escalator clauses.

B. UNIT COST BID

This section is not used.

C. ADD ALTERNATE

Add Alternate #1: Demolish existing window stools and furnish and install new solid surface window stools per details.

$ ____________________________

Add Alternate #2: Furnish and install new exterior louver, flashing, and associated sealant.

$ ____________________________

Add Alternate #3: Furnish and install new window treatments at classrooms and offices.

$ ____________________________

D. DEDUCT ALTERNATE

This section is not used.
E. ADDENDA

The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

Addendum #1 - Pre-Bid RFI Questions dated November 29, 2022

F. BID BOND/PERFORMANCE AND PAYMENT BOND

Cost for providing Performance and Payment Bond & Bid Bond:

Add % of Total Construction Value from $__________ to maximum of $__________.
Add % of next Total Construction Value from $__________ to maximum of $__________.
Add % of next Total Construction Value from $__________ to maximum of $__________.

G. WINDOW PROVIDER INFORMATION

Please indicate proposed Window Provider for this project and anticipated cost:

$____________________
H. LABOR AND MATERIAL RATES

Labor: Unit rates are to be listed for major trades such as, but not limited to, abatement, carpenters, laborers, masons, heavy equipment operators, operators, electricians, HVAC technicians, Foreman/Supervisor for each trade, site superintendent and any other major trade employed in the completion of the Work. Labor rates shall include all overhead, profit, insurance and supervision costs, and shall not be subject to any further markups when utilized in the computation of a Change Order amount. The Owner reserves the right to request additional labor rates. Use additional pages if space provided below is not sufficient.

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<tr>
<th>Trade</th>
<th>Rate: $ __________ per hour</th>
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<td>Laborer Foreman Rate:</td>
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<td>Laborer Rate:</td>
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<td>Carpenter Foreman Rate:</td>
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<td>Carpenter Rate:</td>
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<td>Gypsum (Tape/sand) Foreman Rate:</td>
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<td>Gypsum (Tape/sand) Rate:</td>
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<td>Electrical Foreman Rate:</td>
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<td>Electrical Journeyman Rate:</td>
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<td>Fire Alarm Foreman Rate:</td>
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<td>Fire Sprinkler Foreman Rate:</td>
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<td>HVAC Foreman Rate:</td>
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<td>ATC Foreman Rate:</td>
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<td>Pipe Fitter Rate:</td>
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<td>Abatement Foreman Rate:</td>
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<td>Abatement Laborer Rate:</td>
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Include additional trade labor rates below:

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<tr>
<th>Trade</th>
<th>Rate: $ __________ per hour</th>
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Jensen Hughes
StudioJAED Architects & Engineers
I. FEE FOR PROJECT CHANGES

The total mark-up for each change shall not exceed 15% (10% for overhead + 5% for profit). For changes where the work is performed totally by the Undersigned Bidder’s direct forces, the 15% mark-up shall be assigned to the Undersigned Bidder as the prime contractor. For work performed by a subcontractor(s), a maximum of 10% mark-up will be assigned to all subcontractors and/or sub-subcontractors performing work and 5% will be assigned to the Undersigned Bidder and prime contractor. Unit labor costs are all-inclusive of all OH&P and shall not be subject to further mark-up. The change order mark-ups include all overhead, coordination, bond, insurance, profit and supervision costs, and these items shall not be subject to any further markups when utilized in the computation of a Change Order amount.

For changes which add additional time to the contract completion date, the General Conditions cost impact shall be as listed on the schedule of unit rates above. The unit rate for the general conditions associated with the time extension shall be inclusive of all direct and indirect costs and fees, including but not limited to all overhead, coordination, bond, insurance, cleaning, site support, management, profit and supervision costs, and shall not be subject to any further markups when utilized in the computation of a Change Order. Unit rate shall be for one (1) additional work day.
J. OTHER CERTIFICATIONS

Undersigned agrees to execute Contract for above work for the above stipulated sum provided that he be notified of acceptance of bid within ninety (30) days after time set for the receipt of bids. Undersigned agrees to execute contract and deliver it to the Owner.

Undersigned agrees by submission of this bid that the bidder is the only interested party submitting this bid, that the Contract Documents are incorporated herein, that there is no collusion, and the contract will not be assigned with written consent of the Owner.

Undersigned certifies that included within their bid are only employees and subcontractor employees that will be employed at the worksite that have successfully completed and obtained certification in a course in construction safety and health approved by the United States Occupational Safety and Health Administration as required by the laws of the state.

Undersigned certifies, under penalty of perjury, that to the best of his knowledge and belief that:

The prices in this Bid have been arrived at independently without collusion, consultation, communication or agreement with any other Bidder or competition on any matter whatsoever for the purpose of restricting competition.

Except as may be required by law, prices quoted in this Bid have not been knowingly disclosed prior to the opening of Bids; and

No attempt has been made nor will be made by the Bidder to induce any other person, partnership, or corporation to submit or to refrain from submitting a Bid for this Project.

Undersigned represents to Owner that it has the labor, machinery, equipment, supplies, and credit to meet the schedule completion requirements.

Firm:

Authorized Representative:

Title:

Signature:

Date:

(Corp. Seal) (Notary Seal)

END OF SPECIFICATION
November 29, 2022

East Providence – Riverside Middle School Window Replacement Project

PRE-BID RFI QUESTIONS & RESPONSES

1. Drawing A-651 calls for 1 3/4” thick doors, Specification section 07 43 13 calls for Insulpor 2 ¼” doors. Which is correct?
   Answer: Provide Specification section 07 43 13 Insulpor 2 ¼” doors.

2. Basis of design does not meet design criteria. Manufacturer suggests: 1600Wall system 1, IR501T, or, if the DP is under 45psf, it could be Trifab451T.
   Answer: Use 1600 Wall system 1

3. Will there be any tinted glass on this project? If so, what color?
   Answer: No

4. Will existing aluminum and glass need to be disposed of as ACM?
   Answer: Unknown at this time. ECM Inc. is conducting testing and results will not be available until mid-December. Please provide an alternate fee for if ACM disposal is needed for the aluminum and glass.

5. Spec section 09 96 00, 1.04 mentions sandblasting as prep for steel lintel. Is sandblasting required or would use of wire wheel w/ grinder suffice?
   Answer: Price sandblasting and the Project Team can review a mock-up as the project proceeds.

6. Spec section 01 20 00, 1.2, should contingency be carried in base bid or will owner carry?
   Answer: Owner will carry contingency.

7. It is unlikely that windows can be removed without removing sill, should sills be included in base bud rather than as an alternate?
   Answer: Submit as an alternate.
8. Architect's Drawings, Sheet A6.02, Window Details: Details 1, 2, 9 and 12 all show two piece head receptor located directly under stell lintel / brick shelf. In this location, the fasteners that attach the two piece receptor to the substrate will penetrate the steel lintel and/or (if present) the thru-wall flashing atop the steel lintel, creating a water infiltration issue.

Please provide a different window location inside ← or outside → so the steel lintel thru-wall flashing are not compromised. A deeper window assembly is also an option.

Answer: Details 1, 2, 9, & 12 on A-602 – Provide strap anchors back to interior steel or masonry lintel. Details 1 & 12 includes ¾" trim to hide strap. Add same ¾" trim to details 2 & 9.

9. Architect's Drawings, Sheet A6.02, Window Details: Detail 1 shows the window frame sub-sill / sill starter located so it bridges the exterior brick vaneer and the interior CMU back-up. In this position, the fastener for this framing member most likely falls into the void between the two masonry components. There will be an issue with anchoring the sub-sill / sill starter. It is unlikely that windows can be removed without removing sill, should sills be included in base bud rather than as an alternate?

Please advise, in detailed description how this item should be addressed. A different location inside ← or outside → or a deeper window assembly are also options.

Answer: Detail 1 on A-602 – As shown in the detail (however not noted), provide ¾" plywood to rough opening sill for product attachment.
MINORITY BUSINESS ENTERPRISE REQUIREMENTS AND WOMEN BUSINESS ENTERPRISE PARTICIPATION REQUIREMENTS

Attached (See Appendix A) is the MBE, WBE and/or Disability Business Enterprise Participation Plan form. Bidders are required to complete, sign, and submit with their overall proposal in a sealed envelope. Please complete separate forms for each MBE, WBE, and/or Disability Business Enterprise subcontractor/supplier to be utilized on the solicitation.

In accordance with RI Gen. Law § 37-14.1-1, it is the policy of the State of Rhode Island to support the fullest possible participation of firms owned and controlled by minorities (MBEs) and women (WBEs). Pursuant to §§ 37-14.1-2 and 37-14.1-6, MBEs and WBEs shall be included in all state purchasing, including, but not limited to, the procurement of goods, services, construction projects, or contracts funded in whole or in part with state funds, or funds which, in accordance with a federal grant or otherwise, the state expends or administers. MBEs and WBEs shall be awarded a minimum of ten percent (10%) of the dollar value of the entire procurement or project. MBE participation credit shall only be granted for firms duly certified as MBEs or WBEs by the State of Rhode Island, Department of Administration, Office of Diversity, Equity and Opportunity, MBE Compliance Office (MBECO).

The current directory of firms certified as MBEs or WBEs may be accessed at http://odeo.ri.gov/offices/mbeco/mbe-wbe.php or by contacting Elvys Ruiz at the MBECO at (401) 574-8253 or via email at Elvys.Ruiz@doa.ri.gov.

END OF SPECIFICATION SECTION
Pursuant to RIGL 37-14.1 as well as the regulations promulgated thereto, the MBE Compliance Office requires that you complete the following table. Please note that these figures will be verified with the MBEs identified. If there are outstanding issues, such as retainage or a dispute, please indicate and attach supporting documentation for same. Also note that copies of invoice and cancelled checks for payment to all MBE subcontractors and suppliers are required.

**Contractor/Vendor Name:**

**Project Name & Location:**

<table>
<thead>
<tr>
<th>MBE/WBE Subcontractor</th>
<th>Original Contract Amount</th>
<th>Change Orders</th>
<th>Revised Contract Value</th>
<th>% Completed To Date</th>
<th>Amount Paid To Date</th>
<th>Amount Due</th>
<th>Retainage %</th>
<th>Retainage Amount</th>
<th>Explanation</th>
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I declare, under penalty of perjury, that the information provided in this verification form and supporting documents is true and correct.

____________________________________
Printed Name

Notary Certificate:

Sworn before me this _______ day of _____________ , 20___.

____________________________________
Notary Signature

Commission Expires
Company Name: 

Representative’s Name who administers MBE Program: 

Street Address: 

City, State, Zip: ______________________________ Telephone: __________________

Email: ___________________________ Project Location: ______________________________

Bid or Project #: ___________________________ Date Bid Opened: __________________________

Description of Work: ______________________________________________________________

Contract Value: ___________________________ MBE % Assigned: ________________________

Total # of All Subcontractors/Suppliers used: ______ # of MBE Subcontractors/Suppliers used: ______

**List All Subcontractors/Suppliers/Consultants/Independent Contractors – Total Dollar Amounts – Scope of Work:**

<table>
<thead>
<tr>
<th>Subcontractor / Supplier</th>
<th>Dollar Award</th>
<th>Scope/Description of Work</th>
<th>RI Certified M/WBE Yes/No</th>
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Please note that all MBE/WBE firms must be certified by the RI MBE Compliance Office, and that MBE/WBE firms must self-perform 100% of the work with their own forces or subcontract to another RI certified MBE/WBE in order to receive participation credit. Vendors may count 60% of expenditures for materials and supplies obtained from an MBE certified as a regular dealer/supplier, and 100% of such expenditures obtained from an MBE/WBE certified as a manufacturer. For firms certified as a broker, you may receive MBE participation credit only for the fees and commissions charged for the procurement of the good and materials, but not the cost of the materials themselves.

The above referenced contract will not be released until this plan has been approved by the Director of the Department of Administration or its designee.

For assistance and advice in identifying MBE/WBE firms, please call the Minority Business Enterprise Compliance Office at (401) 574-8670. The directory of all certified MBE firms is also located at [www.mbe.ri.gov](http://www.mbe.ri.gov).

Signature of Authorized Agent of Business: ___________________________ Date: ___________________________

**Send Completed Form to:** Dorinda Keene, Assistant Administrator - MBE
Office of Diversity, Equity and Opportunity (ODEO)
Minority Business Enterprise Compliance Office
One Capitol Hill, 3rd Floor
Providence, RI 02908
Phone: (401) 574-8670
Dorinda.Keene@doa.ri.gov
SECTION 00 95 00
PREVAILING WAGE RATES

**Prevailing Wage** is the cost per hour, for labor wages set by law, involving construction work for various and related trades. It involves a bidding process for contractors that will use federal, state or municipal monies (tax payer dollars) for work on projects that will be used for the public, by the public.

The successful contractor and sub-contractor shall comply with the provisions of Rhode Island General Laws (RIGL) Chapter 37 pertaining to the “Prevailing Wage Laws” for all municipal funded projects in excess of one thousand ($1,000) dollars. The RI Department of Labor has accepted the prevailing wage rates as determined by the applicable Davis Bacon Wage Determination rate schedule found online at the U.S. System for Award Management (SAM) to determine the prevailing wage rates. A copy of the most current wage decision pertaining to this bid is available from the Director of Labor at 401-462-8580, option #7 or on the web site: https://dlr.ri.gov/regulation-and-safety/prevailing-wage/prevailing-wage-forms-and-publications

As required under RIGL 37-13-13, the successful contractor must certify and submit weekly payroll forms to the Finance Director’s Office.

END OF SPECIFICATION SECTION
SECTION 01 10 00
SUMMARY OF WORK

1.0 GENERAL

1.1 Section Includes

A. Contract Description.
B. Work Covered by Contract.
C. Work under other Contracts.
D. Use of Premises.
E. Contractor Use of Premises.
F. Work Restrictions.
G. Work Sequence.
H. Owner Occupancy.

1.2 Contract Description

A. Work of the Project includes the Riverside Middle School Window Replacement Project.
B. Perform the Work of the building under a single Contract under a stipulated sum Contract with the Owner in accordance with the Conditions of Contract.
C. Project will be constructed under a single prime contract.

1.3 Work Covered by Contract

A. The Work under this Contract includes:

1. Provide all labor, material, tools, transportation, equipment, supplies and services to replace the existing windows and curtainwall at Riverside Middle School in accordance with Rhode Island State Building Code (RISBC), Rhode Island State Energy Conservation Code (RISECC), and all local applicable requirements.
   a. Equipment as identified in these Contract Documents.
   b. Windows installed shall meet the requirements of RISBC-1 Section 1604 for Risk Category II as discussed with the East Providence Building Department during project design.
2. Preparation of shop drawings, product data, record drawings, and close out documents in accordance with these Contract Documents. The bid drawings are NOT considered shop drawings. Detailed shop drawings shall be prepared as part of the submittal review process.
3. All other items described in the Contract Documents.
1.4 Work Under Other Contracts

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.5 Use of Premises

A. Contractor shall have limited use of premises for construction operations as indicated on the Contract Documents.

B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits: Confine construction operations to areas indicated on Drawings by Contract limits.
   2. Owner Occupancy: Owner will occupy Project Site during construction
   3. Driveways and Entrances: Keep driveways loading areas and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of building entrances and driveways
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6 Contractor Use of Premises

A. Limit use of premises for Work and for construction operations, to allow for work by other Contractors if necessary.

B. Limit access to site as directed by Owner's Representative.

1.7 Work Restrictions

A. The Work within Riverside Middle School must be completed during 2nd shift (3:00pm – 11:30pm) if school is in session. The Substantial Completion date is the Summer of 2024 (August 16, 2024) before school returns from summer recess. All work must be coordinated so no disruption occurs to ongoing classes and other activities within the building. All work must be coordinated with Riverside Middle School in advance. Coordination with Riverside Middle School will be needed when working in select areas. The Contractor must maintain continued work activity from the start of the project until completion, except on state of Rhode Island recognized holidays.

B. The work activity in the 1st floor classrooms must be limited to the summer months with the exception of the Southeast classrooms as determined by the Owner.

C. The work activity in the 2nd floor classrooms is adaptable to 2nd shift work when school is in session. The Owner can accommodate turning over two (2) classrooms to the Contractor for a duration of three (3) weeks to facilitate construction activity when school is in session. Detailed advanced coordination with the Owner is necessary.

D. Work activity may take place during 1st and 2nd shift if the school is on week long recess/vacation.

E. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

---

Jensen Hughes 01 10 00 - 2
StudioJAED Architects & Engineers

SUMMARY OF WORK
1. Notify Engineer and Owner not less than 3 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner’s written permission.

1.8 Work Sequence

A. Construct the Work to accommodate the Owner’s occupancy requirements. Coordinate the construction schedule and operations with the Owner and Engineer.

B. As part of Substantial Completion, classrooms and other spaces will need to be in a condition where they can be safely occupied by students and staff. Coordinate any proposed work which remains one (1) week in advance of the substantial completion date to ensure there is no impact to school operations.

1.9 Owner Occupancy

A. The Owner intends for the building to be occupied throughout construction.

B. Cooperate with the Owner to minimize conflict, and to facilitate the Owner’s operations.

C. Schedule the Work to accommodate Owner occupancy.

END OF SPECIFICATION SECTION
SECTION 01 11 00
GENERAL REQUIREMENTS - SUMMARY

1.0 GENERAL

1.1 Summary of Work
   A. Project is to include, but not limited to, all labor and materials to complete the scope of work indicated on the design drawings and specifications. Windows installed shall meet the requirements of RISBC-1 Section 1604 for Risk Category II as discussed with the East Providence Building Department during project design.

1.2 Contract Method
   A. Construct the work under a single lump sum contract.

1.3 Background Checks
   A. There are a growing number of Rhode Island laws that require individuals to provide a fingerprint-based national background for purposes of employment, operating a business or serving as a caregiver. Each statute dictates where individuals may obtain the national background checks: the Office of Attorney General, the Rhode Island State Police, and/or your local police department.
   B. Vendors must be sure to register their company with the RI Office of Attorney General (401-274-4400) before sending employees for their fingerprint-based national background check.
   C. The following must obtain national background check at the Office of Attorney General Customer Service Center, located at 4 Howard Avenue, Cranston, RI.
      1. Firefighter
      2. Medical marijuana caregiver
      3. Dept. of Child Youth and Families (DCYF) employees
      4. Public and private school employees (full time, part time, substitute teacher, school bus drivers and monitors)
      5. Third party public and private school vendors
   D. Out of State: If you live out of state and require a national background check, please download and complete the forms at the bottom of http://www.riag.ri.gov/homeboxes/BackgroundChecks.php and submit with your fingerprints to the Office of Attorney General.

1.4 Existing Conditions
   A. The contractor shall familiarize themselves with the building, existing conditions and other applicable information prior to the installation. Any discrepancies are to be reported to the Owner immediately.
1.5 **Substitutions**

A. All substitutions are to be made within 15 days after the Owner/Contractor Agreement is executed. All substitutions will be considered only when a product becomes unavailable due to no fault of the Contractor.

B. Document each request with complete data substantiating compliance of the proposed substitution with the Contract Documents.

C. Request constitutes a representation that the Contractor:

1. Has reasonably investigated the proposed product and determined that it meets or exceeds the specified product.
2. Will provide the same warranty for substitution as for the specified product.
3. Will coordinate the installation and make other changes which may be required for Work to be completed in all respects.
4. Waive claims for additional costs, which may occur.
5. Substitutions will not be considered when they are first indicated on shop drawings or submittals without prior approval.
6. Owner will determine the acceptability of proposed substitutions and will notify the Contractor of acceptance or rejection in writing within a reasonable time period. Decisions of the Owner as to the acceptability of the substitutions are final.

1.6 **Temporary Facilities**

A. If the existing building is to be used as a construction office. The location of the construction office is to be determined but will be in the immediate vicinity of the construction area.

1.7 **Meetings**

A. Pre-Construction Kick-Off Meeting: Following execution of the Construction Contract, the Contractor is to attend a Pre-Construction meeting to discuss the use of the site, project schedule, labor requirements and other issues related to the project.

2.0 **PRODUCTS**

Not Applicable

3.0 **EXECUTION**

Not Applicable

**END OF SPECIFICATION**
1.0 GENERAL

1.1 Summary
A. The specification section includes requirements for volatile organic compound (VOC) content in adhesives, sealants, paints, and coatings used for this project.

1.2 Related Sections
A. The following Specification Sections contain requirements that relate to this Specification Section:
   1. Section 01 11 00 – General Requirements Summary
   2. Section 09 91 23 – Interior Painting
   3. Section 09 96 00 – High Performance Coatings

1.3 General Requirements
A. The Contractor is required to implement practices and procedures to meet the project’s environmental goals, which include achieving NE-CHPS criteria. Specific project goals which may impact this area of work are listed in the applicable paragraphs of this specification section. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in the related sections of the Contract Documents, are implemented to the fullest extent feasible.

1.4 References

1.5 VOC Requirements for Interior Adhesives
A. The volatile organic compound (VOC) content of adhesives, adhesive bonding primers or adhesive primers used in this project shall not exceed the limits defined in Rule 1168 – “Adhesive and Sealant Applications.”
B. The VOC limits defined by SCAQMD are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.
1.6 General

A. Unless otherwise specified below, the VOC content of all adhesive, adhesive bonding primers and adhesive primers are to be in excess of 250 grams per liter.

B. For specified building construction related applications, allowable VOC content is as follows:

1. Architectural Applications
   a. Indoor carpet adhesive 50
   b. Carpet pad adhesive 50
   c. Wood floor adhesive 100
   d. Rubber floor adhesive 60
   e. Subfloor adhesive 50
   f. Ceramic tile adhesive 65
   g. VCT and asphalt tile adhesive 50
   h. Drywall and panel adhesive 50
   i. Cove base adhesive 50
   j. Multipurpose construction adhesive 70
   k. Structural glazing adhesive 100

1.7 VOC Requirements for Interior Sealants

A. The VOC content of sealants, or sealant primers used in this project shall not exceed the limits defined in Rule 1168 – “Adhesive and Sealant Applications.”

B. The VOC limits defined by SCAQMD are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.

1. Sealants
   a. Architectural 250
   b. Other 420

2. Sealant Primer
   a. Architectural – Nonporous 250
   b. Architectural – Porous 775
   c. Other 750

1.8 VOC Requirements for Interior Paints

A. Paints and Primers: Paints and primers used in non-specialized interior applications (i.e., for wallboard, plaster, wood, metal doors and frames, etc.) shall meet the VOC limitations of the Green Seal Paint Standard GS-11, of Green Seal, Inc., Washington, DC. Product-specific environmental requirements are as follows:

1. Volatile Organic Compounds
   a. The VOC concentrations (in grams per liter) of the product shall not exceed those listed below as determined by the U.S. Environmental Protection Agency (EPA) Reference Test Method 24.

   1) Interior Paints and Primers (non-flat) – 150 g/l
   2) Interior Paints and Primers (flat) – 50 g/l
B. Anti-Corrosive and Anti-Rust Paints

1. Anti-corrosive and anti-rust paints applied to interior ferrous metal substances shall meet the VOC limitations of the Green Seal Paint Standard GS-03 requirements as follows:
   a. Volatile Organic Compounds
      1) The VOC concentrations (in grams per liter) of the product shall not exceed those listed by the EPA Reference Test Method 24: Anti-Corrosive and Anti-Rust Paints – 250 g/l.

1.9 VOC Requirements for Interior Coatings

A. Clear wood finishes, floor coatings, stains, sealers and shellacs applied to the interior shall meet the VOC limitations defined in Rule 113. The VOC limits defined by SCAQMD, based on 07/09/04 amendments, are as follows. VOC limits are defined in grams per liter, less water and less exempt compounds.

1. Clear wood finishes - Varnish 350
2. Clear wood finishes – Sanding Sealers 350
3. Clear wood finishes – Lacquer 550
4. Shellac – Clear 730
5. Shellac – Pigmented 550
6. Stains 250
7. Floor Coatings 100
8. Waterproofing Sealants 250
9. Sanding Sealers 275
10. Other Sealers 200

2.0 PRODUCTS

Not Applicable

3.0 EXECUTION

Not Applicable

END OF SPECIFICATION
SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

1.0 GENERAL

1.1 Section Includes
A. Contingency allowances.
B. Schedule of values.
C. Applications for payment.
D. Sales tax exemption.
E. Change procedures.
F. Defect assessment.
G. Alternates.

1.2 Contingency Allowances
A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from a Contingency Allowance.
B. Funds will be drawn from the Contingency Allowance only by Change Order.
C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.3 Schedule of Values
A. Submit Schedule of Values in duplicate, one copyrighted original and one copy, prior to commencement of work.
B. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Organize the Schedule of Values by trade and to reflect the general organization of the work. The Schedule of values and the Project Schedule must reflect each other in organization and break down.
C. Include in each line item, the amount of Allowances specified in this Section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
D. Include in the schedule of Values the following Specific Line Items:
   1. Mobilization
   2. Demobilization
   3. Builder's Risk Insurance
4. Bond
5. Coordination Drawings
6. Scheduling
7. Project Photographs
8. Preconstruction Video, Survey, Photographs
9. Mock ups / Bench Marks for each Trade
10. Field Engineering, Bench Marks
11. Daily Clean up in the building
12. Site Clean up
13. Safety Compliance
14. GC Home office Overhead and Project Profit (paid proportionally to the percent complete of the project)
15. Full Time Superintendent
16. Field office rental and operation
17. Monthly Progress Drawing updates
18. Dumpsters / Trash removal
19. Winter protection
20. Temporary Heat
21. Testing Allowance
22. Contingency Allowance
23. Any other Allowances from the Bid Form
24. Warrantee Retainage
25. Project Close out (Beyond As built Drawings)

E. Revise schedule to list approved Change Orders, with each Application for Payment.

1.4 Applications for Payment

A. Submit each application on an original copyrighted AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet, accompanied by three (3) copies.

1. Individually sign and notarize, and emboss with notary's official seal, the original and each of the three (3) copies.
2. Applications not including original copyrighted AIA G702, and G703 Forms, will be rejected, and returned for re-submittal.
3. Applications not properly signed and notarized will be rejected, and returned for re-submittal.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Provide one (1) hard copy and one (1) electronic copy of the updated construction schedule with each Application for Payment submission.

1. Provide a statement signed by the Contractor's firm principal certifying that there are no unidentified outstanding claims for delay.

D. Include with each monthly Application for Payment, following the first application, one (1) copy of the Certified Monthly Payroll Record for the previous month's pay period.

E. Payment Period: Submit at intervals stipulated in the Agreement.

F. Submit with transmittal letter as specified for Submittals.

G. Substantiating Data: When the Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with the Application for Payment:
1. Record Documents as specified, for review by the Owner which will be returned to the Contractor.

2. Affidavits attesting to off-site stored products.

3. Construction progress schedules, revised and current.

1.5 Sales Tax Exemption

A. Owner is exempt from sales tax on products permanently incorporated in Work of the Project.

   1. Obtain sales tax exemption certificate number from Owner.
   2. Place exemption certificate number on invoice for materials incorporated in the Work of the Project.
   3. Furnish copies of invoices to Owner.
   4. Upon completion of Work, file a notarized statement with Owner that all purchases made under exemption certificate were entitled to be exempt.
   5. Pay legally assessed penalties for improper use of exemption certificate number.

1.6 Change Procedures

A. Submittals: Submit name of the individual authorized to receive change documents and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time by issuing supplemental instructions on AIA Form G710.

C. The Engineer may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within fifteen (15) days.

D. The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation, and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01 60 00.

E. Stipulated Sum Change Order: Based on Proposal Request, and Contractor's fixed price quotation, or Contractor's request for a Change Order as approved by Engineer.

F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute the Work under a Construction Change Directive. Changes in the Contract Sum or Contract Time will be computed as specified for a Time and Material Change Order.

G. Construction Change Directive: The Engineer may issue a directive, on AIA Form G713 Construction Change Directive signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in the Contract Sum or Contract Time. Promptly execute the change.
H. **Time and Material Change Order:** Submit an itemized account and supporting data after completion of the change, within the time limits indicated in the Conditions of the Contract. The Engineer will determine the change allowable in the Contract Sum and Contract Time as provided in the Contract Documents.

I. **Maintain detailed records of work done on a Time and Material basis.** Provide full information required for an evaluation of the proposed changes, and to substantiate costs for the changes in the Work. Submit form “Breakdown of Hourly Rates” attached at the end of this section.

J. **Document each quotation for a change in cost or time with sufficient data to allow an evaluation of the quotation.** Provide detailed breakdown of costs and estimates for labor and materials including a detailed breakdown for subcontractor's or vendor's Work. Include copies of written quotations from subcontractors or vendors.

K. **Change Order Forms:** AIA G701 Change Order.

L. **Execution of Change Orders:** The Engineer will issue Change Orders for signatures of the parties as provided in the Conditions of the Contract.

M. **Correlation of Contractor Submittals:**
   1. Promptly revise the Schedule of Values and the Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in the Contract Time, revise sub-schedules to adjust times for any other items of work affected by the change, and resubmit.
   2. Promptly enter changes in the Project Record Documents.

### 1.7 Defect Assessment

A. **Replace the Work, or portions of the Work, not conforming to specified requirements.**

B. **If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct an appropriate remedy or adjust payment.**

C. **The defective Work may remain, but the unit sum will be adjusted to a new sum at the discretion of the Engineer.**

D. **The defective Work will be partially repaired to the instructions of the Engineer, and the unit sum will be adjusted to a new sum at the discretion of the Engineer.**

E. **The individual Specification Sections may modify these options or may identify a specific formula or percentage sum reduction.**

F. **The authority of the Engineer to assess the defect and identify a payment adjustment, is final.**

G. **Non-Payment for Rejected Products:** Payment will not be made for rejected products for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from the transporting vehicle.
   4. Products placed beyond the lines and levels of the required Work.
   5. Products remaining on hand after completion of the Work.
1.8 Alternates

A. The Contractor shall submit separate prices for the following Add Alternates as described in Section 00 10 00 and on the bid documents.

1. Demolish existing window stools and furnish and install new solid surface window stools per details.
2. Furnish and install new exterior louver, flashing, and associated sealant.
3. Furnish and install new window treatments at classrooms and offices.

END OF SPECIFICATION
SECTION 01 30 00
ADMINISTRATIVE PROCEDURES

1.0 GENERAL

1.1 Section Includes

A. Site administration
B. Construction progress schedules.
C. Coordination and project conditions.
D. Preconstruction meeting.
E. Site mobilization meeting.
F. Progress meetings.
G. Pre-installation meeting.

1.2 Site Administration

A. Maintain a daily attendance log to include the names of all project employees and guests to the site. The log sheet or sheets must clearly indicate the Project Name, and the name of the General Contractor. Each line on the log should allow for the name of each employee, the employee's job title (use terminology used by prevailing wage job title), and the name of that employee’s employer. Each guest signing the log should indicate a brief description of the reason for the visit, and that guest’s employer or organization.

1.3 Coordination and Project Conditions

A. Coordinate the scheduling, submittals, and the Work of the various Sections of the Project Manual to ensure an efficient and orderly sequence of the demolition elements.
B. Coordinate the completion and cleanup of the Work of the separate Sections in preparation for Substantial Completion.
C. Coordinate access to the site for correction of defective Work and the Work not in accordance with the Contract Documents.

1.4 Construction Progress Schedules

A. Submit initial progress schedule in duplicate within 15 days after date of established notice to proceed for Engineer to review.
B. Revise and resubmit as required.
C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
D. Submit a computerized chart with separate line for each major section of Work or operation, identifying first work day of each week.

E. Show complete sequence of construction activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

F. Indicate estimated percentage of completion for each item of Work at each submission.

G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by the Owner and under Allowances.

1.5 Preconstruction Meeting

A. The Engineer will schedule a meeting after contract award.

B. Attendance Required: Owner, Engineer, and Contractor.

C. Agenda:
1. Execution of the Owner-Contractor Agreement.
2. Submission of the executed bond and insurance certificates.
4. Submission of a list of Subcontractors, a list of products, schedule of values, and a progress schedule.
5. Designation of the personnel representing the parties in the Contract, and the Engineer.
6. The procedures and processing of the field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders, and Contract closeout procedures.
7. Scheduling.

D. Record the minutes and distribute copies within two days after the meeting to the participants, with two copies to the Engineer, the Owner, the participants, and those affected by the decisions made.

1.6 Site Mobilization Meeting

A. The Contractor will schedule a meeting at the Project site prior to the Contractor's occupancy.

B. Attendance Required: The Owner, Engineer, Contractor, the Contractor's Superintendent, and major Subcontractors.

C. Agenda:
1. Use of the premises by the Contractor.
2. The Owner’s requirements and partial occupancy.
3. Construction facilities and controls provided by the Owner.
4. Temporary utilities provided by the Owner.
5. Security and housekeeping procedures.
7. Application for payment procedures.
8. Procedures for testing.
9. Procedures for maintaining the record documents.

D. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Engineer, Owner, participants, and those affected by the decisions made.
1.7  Progress Meetings

A. Schedule and administer the meetings throughout the progress of the Work at maximum monthly intervals.

B. Make arrangements for the meetings, prepare the agenda with copies for the participants, and preside at the meetings.

C. Attendance Required: The job superintendent, major subcontractors and suppliers, the Owner, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review the minutes of previous meetings.
   2. Review of the Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of the problems which impede the planned progress.
   5. Review of the submittals schedule and status of the submittals.
   7. Maintenance of the progress schedule.
   8. Corrective measures to regain the projected schedules.
   9. Planned progress during the succeeding work period.
  10. Coordination of the projected progress.
  11. Maintenance of the quality and work standards.
  12. Effect of the proposed changes on the progress schedule and coordination.
  13. Other business relating to the Work.

E. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Engineer, Owner, participants, and those affected by the decisions made.

1.8  Pre-Installation Meeting

A. When required in the individual specification Sections, convene a pre-installation meeting at the site prior to commencing the Work of the Section.

B. Require attendance of the parties directly affecting, or affected by, the Work of the specific Section.

C. Notify the Engineer four days in advance of the meeting date.

D. Prepare an agenda and preside at the meeting:
   1. Review the conditions of installation, preparation and installation procedures.
   2. Review coordination with the related work.

E. Record the minutes and distribute the copies within two days after the meeting to the participants, with two copies to the Engineer, Owner, participants, and those affected by the decisions made.
SECTION 01 31 50
NE-CHPS SUBMITTALS

1.0 GENERAL

1.1 Summary

A. This specification section specifies administrative and procedural requirements for submittals required to achieve the specified NE-CHPS certification.

B. Sustainable Design Intent: Comply with project requirements intended to achieve a Certified Rating, measured and documented according to the Northeast Collaborate for High Performance Schools Criteria (NE-CHPS) Version 3.1.

1.2 Related Sections

A. The following Specification Sections contain requirements that relate to this Specification Section:

1. Section 01 10 00 – General Requirements Summary

1.3 General Requirements

A. The Contractor is required to implement practices and procedures to meet the project's environmental goals, which include achieving NE-CHPS criteria. Specific project goals which may impact this area of work are listed in the applicable paragraphs of this specification section. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in the related sections of the Contract Documents, are implemented to the fullest extent feasible.

1.4 Submittal Procedures

A. NE-CHPS submittal requirements are to include submission of MATERIALS CREDITS DOCUMENTATION SHEET. Information to be supplied for this form includes, but is not limited to, the following:

1. Cost breakdowns for materials included in the contractor’s or subcontractor’s work. Cost breakdowns include total cost plus labor, equipment and material costs.
2. The amount of savaged, refurbished or reused materials and products.
3. The amount of recycled content in the supplied products, with percentages broken down to indicate post-consumer and pre-consumer percentages.
4. The location of the raw materials extracted, harvested, or recovered and then used to manufacture the supplied products.
5. The manufacture location for the supplied products.

B. Submit Letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the MATERIALS CREDITS DOCUMENTATION SHEET.
C. Submit Product Data Sheets for materials that meet the NE-CHPS Building Performance criteria.

D. Submit certification required for Construction Waste Management, Construction IAQ Management and Construction Pollution Controls.

E. Submit Material Safety Data Sheets (MSDS) for all applicable products.

F. Submittals shall be provided in approved NE-CHPS format.

2.0 PRODUCTS

Not Applicable

3.0 EXECUTION

Not Applicable

END OF SPECIFICATION
SECTION 01 35 20
INDOOR AIR QUALITY MANAGEMENT

1.0 GENERAL

1.1 Summary

A. Section includes special requirements for Indoor Air Quality (IAQ) management during construction operations.
   1. Control of emissions during construction.
   2. Moisture control during construction.

B. Procedures for testing baseline IAQ. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

1.2 Definitions

A. Definitions pertaining to sustainable development as defined in ASTM E2114.

B. Adequate Ventilation: Ventilation, including, air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors or gases.

C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200.

D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in the building with respect to the contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air.

E. Interior Final Finishes: Materials and products that will be exposed at interior, occupied spaces including flooring, wallcovering, finish carpentry and ceilings.

F. Packaged Dry Products: Materials and products that are installed in dry form and are delivered to the site in manufacturer’s packaging including carpets, resilient flooring, ceiling tiles and insulation.

G. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.3 Preconstruction Meeting

A. Following award of Contract and prior to commencement of project work, the Contractor is required to schedule a meeting with the Owner and project team to discuss the proposed IAQ management plan.
1.4 Submittals

A. IAQ Management Plan is to be provided prior to preconstruction meeting and is required to include the following information:
   1. Procedures for control of emissions during construction
   2. Procedures for moisture control during construction

B. Product Data:
   1. Product data for filtration media used during construction and during operations.
   2. Submit air pressure difference maps for mode of operation of HVAC.
   3. Material Safety Data Sheets
   4. Inspection test reports.

2.0 PRODUCTS

Not Applicable

3.0 EXECUTION

3.1 IAQ Management – Emissions Control

A. During construction operations, follow the recommendations in SMACNA IAQ Guidelines for Occupied Buildings under Construction.

B. HVAC Protection
   1. Seal return registers during construction
   2. Provide temporary exhaust during construction operations

C. Source Control – provide low and zero VOC materials as specified.

D. Pathway Interruption – isolate areas of work as necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials, as required, to protect clean or occupied spaces.

E. Housekeeping – during construction, maintain project and building products and systems to prevent contamination of building spaces.

F. Temporary Ventilation – provide and ACH (air changes per hour) of 1.5 or more and as follows:
   1. Provide minimum 48-hour pre-ventilation of packages dry products prior to installation. Remove from packaging and ventilate in a secure, dry and ventilated space.
   2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.

G. Scheduling – schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.

H. Flush-Out – After the conclusion of construction, and prior to occupancy, perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60-degrees F and relative humidity no greater than 60%.

END OF SPECIFICATION
SECTION 01 40 00
QUALITY REQUIREMENTS

1.0 GENERAL

1.1 Section Includes
A. Quality control and control of installation.
B. Verification of Credentials and Licenses.
C. Tolerances
D. References.
E. Mock-up requirements.
F. Testing and inspection services.
G. Manufacturers’ field services.

1.2 Quality Control and Control of Installation
A. Monitor a quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of the specified quality.
B. Comply with the manufacturers’ instructions, including each step-in sequence.
C. When the manufacturers’ instructions conflict with the Contract Documents, request a clarification from the Engineer before proceeding.
D. Comply with the specified standards as a minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Perform the Work by persons qualified to produce the required and specified quality.
F. Verify that field measurements are as indicated on the Shop Drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 Verification of Credentials and Licenses
A. An element of this oversight process is the verification that persons employed on the project site have appropriate and current credentials and licenses in their possession, at the project site, for the work they are performing.
B. Be forewarned that state resident inspectors will be checking for verification of credentials and licenses of both union and non-union persons, in their onsite inspections.
C. State resident inspectors will also be reviewing Contractor's Certified Monthly Payroll Records for conformance with RI State Prevailing Wage Rate requirements.

D. Those persons without the appropriate credentials and licenses will be subject to dismissal from the project site.

1.4 Tolerances

A. Monitor the fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with the manufacturers' tolerances. When the manufacturers' tolerances conflict with the Contract Documents, request a clarification from the Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.5 References

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by the date of issue current on the date of the Contract Documents, except where a specific date is established by code.

C. Obtain copies of the standards where required by the product specification Sections.

D. When the specified reference standards conflict with the Contract Documents, request a clarification from the Engineer before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in the Contract, nor those of the Engineer, shall be altered from the Contract Documents by mention or inference otherwise in reference documents.

1.6 Mock-Up Requirements

A. Tests will be performed under the provisions identified in this Section and identified in the respective product specification Sections.

B. Assemble and erect the specified items with the specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be a comparison standard for the remaining Work.

D. Where the mock-up has been accepted by the Engineer and is specified in the product specification Sections to be removed, remove the mock-up and clear the area when directed to do so by the Engineer.

1.7 Testing and Inspection Services

A. The Contractor will submit the name of an independent firm to the Engineer for approval by the Owner, to perform the testing and inspection services.
B. The independent firm will perform the tests, inspections and other services specified in the individual specification Sections and as required by the Engineer.
   1. Laboratory: Authorized to operate in the location in which the Project is located.
   2. Laboratory Staff: Maintain a full time registered Engineer on staff to review the services.
   3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards or to the accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off the project site. Perform off-site testing as required by the Engineer or the Owner.

D. Reports will be submitted by the independent firm to the Engineer and the Contractor, in duplicate, indicating the observations and results of tests and indicating the compliance or non-compliance with Contract Documents.

E. Cooperate with the independent firm; furnish samples of the materials, design mix, equipment, tools, storage, safe access, and the assistance by incidental labor as requested.
   1. Notify the Engineer and the independent firm 24 hours prior to the expected time for operations requiring services.
   2. Make arrangements with the independent firm and pay for additional samples and tests required for the Contractor's use.

F. Testing and employment of the testing agency or laboratory shall not relieve the Contractor of an obligation to perform the Work in accordance with the requirements of the Contract Documents.

G. Re-testing or re-inspection required because of a non-conformance to the specified requirements shall be performed by the same independent firm on instructions by the Engineer.

H. Payment for the re-testing or re-inspection will be charged to the Contractor by deducting the testing charges from the Contract Sum.

I. Agency Responsibilities:
   1. Test samples of mixes submitted by the Contractor.
   2. Provide qualified personnel at the site. Cooperate with the Engineer and the Contractor in performance of services.
   3. Perform specified sampling and testing of the products in accordance with the specified standards.
   4. Ascertain compliance of the materials and mixes with the requirements of the Contract Documents.
   5. Promptly notify the Engineer and the Contractor of observed irregularities or non-conformance of the Work or products.
   6. Perform additional tests required by the Engineer.
   7. Attend the preconstruction meetings and the progress meetings.

J. Agency Reports: After each test, promptly submit two copies of the report to the Engineer and to the Contractor. When requested by the Engineer, provide an interpretation of the test results.

K. Include the following:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.

L. Limits On Testing Authority:
   1. Agency or laboratory may not release, revoke, alter, or enlarge on the requirements of the
      Contract Documents.
   2. Agency or laboratory may not approve or accept any portion of the Work.
   3. Agency or laboratory may not assume any duties of the Contractor.
   4. Agency or laboratory has no authority to stop the Work.

1.8 Manufacturers’ Field Services

   A. When specified in the individual specification Sections, require the material or Product suppliers, or
      manufacturers, to provide qualified staff personnel to observe the site conditions, the conditions of
      the surfaces and installation, the quality of workmanship, the start-up of equipment, or test, adjust
      and balance of equipment as applicable, and to initiate instructions when necessary.

   B. Submit the qualifications of the observer to the Engineer 30 days in advance of the required
      observations. Observer, subject to approval of Engineer.

   C. Report the observations and the site decisions or instructions given to the applicators or installers that
      are supplemental or contrary to the manufacturers’ written instructions.

END OF SPECIFICATION
SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

1.0 GENERAL

1.1 Section Includes

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Temporary water service.
   7. Temporary sanitary facilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.

C. Temporary Controls:
   2. Fire detection.
   3. Water control.
   4. Dust control.
   5. Erosion and sediment control.
   6. Noise control.
   7. Pest control.
   8. Pollution control.
   9. Rodent control.

1.2 Summary

A. This section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 Temporary Electricity

A. The Owner will pay the cost of energy used. Exercise measures to conserve energy. Utilize the Owner’s existing power service.

1.4 Temporary Lighting for Construction Purposes

A. Permanent building lighting maybe utilized during construction.

1.5 Temporary Heating
A. Existing facilities shall be used.

1.6 Temporary Cooling
A. Existing facilities shall be used.

1.7 Temporary Ventilation
A. Utilize the existing ventilation equipment. Extend and supplement the equipment with temporary fan units as required to maintain clean air for construction operations.

1.8 Temporary Water Service
A. The Owner will pay the cost of temporary water. Exercise measures to conserve energy. Utilize the Owner's existing water system, extend and supplement with temporary devices as needed to maintain the specified conditions for construction operations.

1.9 Temporary Sanitary Facilities
A. The existing designated facilities located within each building may be used during construction operations. Maintain daily in a clean and sanitary condition.
B. At the end of construction, return the facilities to the same or better condition as the original condition.

1.10 Field Offices and Sheds
A. A designated existing space within the building may be used for field offices upon approval of Owner.

1.11 Vehicular Access
A. Location as approved by the Owner.
B. Provide unimpeded access for emergency vehicles. Maintain 20-foot width driveways with turning space between and around combustible materials.
C. Provide and maintain access to fire hydrants and control valves free of obstructions.
D. Use designated existing on-site roads for construction traffic.

1.12 Parking
A. Locate as approved by the Owner.
B. When site space is not adequate, arrange through the Owner for additional off-site parking.
C. Use of designated existing on-site streets and driveways for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.
D. Use of designated areas of existing parking facilities by construction personnel is permitted.
E. Do not allow heavy vehicles or construction equipment in parking areas.

1.13 Progress Cleaning and Waste Removal
A. Maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition. Building must be clear of all debris at conclusion of each day. The building will remain a fully occupied building for the duration of the project.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean the interior areas prior to the start of surface finishing and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from the site periodically, weekly, or daily, as necessary to prevent an on-site accumulation of waste material, debris, and rubbish, and dispose off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 Security

A. Security Program:
   1. Protect the Work, the existing premises, or the Owner's operations from theft, vandalism, and unauthorized entry.
   2. Initiate the program in coordination with the Owner's existing security system at the mobilization.
   3. Maintain the program throughout the construction period until Owner occupancy.

B. Entry Control:
   1. Restrict the entrance of persons and vehicles into the Project site, or the existing facilities.
   2. Allow entrance only to authorized persons with the proper identification.
   3. Maintain a log of workers and visitors, make available to the Owner on request.
   4. Coordinate the access of the Owner's personnel to the site in coordination with the Owner's security forces.

1.15 Fire Detection

A. Each day, before beginning any construction operations that can potentially trigger the existing fire alarm detection system, the Contractor is permitted to temporarily disconnect the system in the specific areas of construction, for as long as may be necessary. The Owner shall be notified each time the existing system is disabled.

B. Failure to so notify the Owner will subject the Contractor to a monetary fine for each occurrence, should the fire detection system be activated inadvertently by a construction activity.

1.16 Water Control

A. Grade the site to drain. Maintain excavations free of water. Provide, operate, and maintain the pumping equipment.

B. Protect the site from puddling or running water. Provide water barriers as required to protect the site from soil erosion.

1.17 Dust Control
A. Execute the Work by methods to minimize raising dust from construction operations.
B. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.

1.18 Erosion and Sediment Control
A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
B. Minimize the amount of bare soil exposed at one time.
C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
E. Periodically inspect the earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.19 Noise Control
A. Provide methods, means, and facilities to minimize noise produced by the construction operations.

1.20 Pest Control
A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work, or entering the facility.

1.21 Pollution Control
A. Provide methods, means, and facilities to prevent the contamination of soil, water, and the atmosphere from discharge of noxious, toxic substances, and pollutants produced by the construction operations.

1.22 Rodent Control
A. Provide methods, means, and facilities to prevent rodents from accessing or invading the premises.

END OF SPECIFICATION
SECTION 01 60 00
PRODUCT REQUIREMENTS

1.0 GENERAL

1.1 Section Includes

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

1.2 Products

A. Products: Means new material, machinery, components, fixtures, or systems forming the Work; but does not include the machinery or equipment used for the preparation, fabrication, conveying, or erection of the Work. Products may include the existing materials or components required or specified for reuse.

B. Furnish products of qualified manufacturers suitable for the intended use. Furnish products of each type by a single manufacturer unless specified otherwise.

C. Do not use materials and equipment removed from the existing premises, except as specifically permitted by the Contract Documents.

D. Furnish interchangeable components of the same manufacturer for the components being replaced.

1.3 Product Delivery Requirements

A. Transport and handle products in accordance with the manufacturer's instructions.

B. Promptly inspect shipments to ensure that the products comply with the requirements, the quantities are correct, and the products are undamaged.

C. Provide equipment and personnel to handle the products by methods to prevent soiling, disfigurement, or damage.

1.4 Product Storage and Handling Requirements

A. Store and protect the products in accordance with the manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to the product.
D. For exterior storage of fabricated products, place on sloped supports above the ground.

E. Provide bonded off-site storage and protection when the site does not permit on-site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent the condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store the products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of the products to permit access for inspection. Periodically inspect to verify that the products are undamaged and are maintained in acceptable condition.

1.5 Product Options

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of the manufacturers named and meeting the specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.6 Product Substitution Procedures

A. Instructions to Bidders specify the time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.

B. Substitutions may be considered only when a product becomes no longer in production following the date of receipt of the Purchase Order for this Contract. Submit certification both that specified product was carried in Bid and is no longer obtainable.

C. Document each request with complete data substantiating the compliance of a proposed Substitution with the Contract Documents.

D. A request constitutes a representation that the Bidder:
   1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the Substitution as for the specified Product.
   3. Will coordinate the installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse the Owner and the Engineer for review or redesign services associated with re-approval by the authorities having jurisdiction.
E. Substitutions will not be considered when they are indicated or implied on the Shop Drawing or Product Data submittals, without a separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure, If Permitted Following Contract Award:
   1. Submit three copies of a request for Substitution for consideration, no later than 20 working days following date of receipt of the Purchase Order for this Contract. Limit each request to one proposed Substitution.
   2. Submit the Shop Drawings, Product Data, and the certified test results attesting to the proposed product equivalence. The burden of proof is on the proposer.
   3. The Engineer will notify the Contractor in writing of a decision to accept or reject the request.

END OF SPECIFICATION
SECTION 01 70 00
EXECUTION REQUIREMENTS

1.0 GENERAL

1.1 Section Includes

A. Examination.
B. Preparation.
C. Protection of adjacent construction.
D. Cutting and patching.
E. Special procedures.
F. Progress cleaning and waste removal.
G. Final cleaning.
H. Starting and adjusting of systems.
I. Demonstration and Instructions.
J. Testing, adjusting and balancing.
K. Protecting Installed Construction.

1.2 Examination

A. Acceptance of Conditions:
   1. Verify that existing applicable site conditions, substrates, or substrate surfaces are acceptable or meet specific requirements of individual specifications Sections, for subsequent Work to proceed.
   2. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
   3. Examine and verify specific conditions described in individual specifications Sections.
   4. Verify that utility services are available, of correct characteristics, and in correct locations.
   5. Beginning of new Work, that relies upon the quality and proper execution of Work of a preceding trade, means acceptance of that preceding Work as appropriate for the proper execution of subsequent Work.
   6. Acceptance of preceding Work that can be shown later to have adversely affected proper performance of new Work may result in removal and repeat performance of all Work involved at no cost to the Owner.

1.3 Preparation

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply substrate primer, sealer, or conditioner, required or recommended by manufacturer, prior to applying any new material or substance in contact or bond.

D. Prior to the application, installation, or erection of any products and product components, perform any other preparatory operations, or surface or substrate modifications, as may be specified or directed by product manufacturers.

1.4 Protection of Adjacent Construction

A. Protect existing adjacent properties and provide special protection where specified in individual Specification Sections.

B. Provide protective coverings at wall, projections, jambs, sills, and soffits of existing openings.

C. Protect existing finished floors, stairs, and other existing surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

D. Repair adjacent properties damaged by construction operations to original condition to the satisfaction of the Owner

E. Prohibit unnecessary traffic from existing landscaped areas.

F. Restore grassed landscaped areas damaged by construction operations to full healthy growth, by installing loam and sod to the requirements, and under the supervision of, the Owner.

1.5 Cutting and Patching

A. Employ original, or skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements which affect:
   1. Structural integrity of element.
   2. Integrity of weather-exposed or moisture-resistant elements.
   3. Efficiency, maintenance, or safety of element.
   5. Existing construction, or Work of separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install or correct ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute Work by methods that will avoid damage to other Work and provide proper surfaces to receive patching and finishing.

E. Cut masonry, concrete, and other rigid materials using masonry saw or core drill.

F. Restore Work with new Products in accordance with requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
**EXECUTION REQUIREMENTS**

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. At penetration of fire rated, partitions, ceiling, or floor construction completely seal voids with fire rated or fire-resistant material in accordance with Section 07840, to full thickness of the penetrated element.

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

K. Identify any hazardous substance or conditions exposed during the Work to the Engineer for decision or remedy.

1.6 **Special Procedures**

A. Materials: As specified in product Sections; match existing with new products, or salvaged products as appropriate, for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to provide installation of new Work and finishes.

G. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring products and finishes to original or specified condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces to specified condition for each material, with a neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Engineer for review.

L. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition to Engineer for review.

M. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

N. Patch or replace portions of existing surfaces which are damaged, or showing other imperfections.

O. Finish the surfaces as specified in individual product Sections, or as indicated on the Drawings.
1.7  Progress Cleaning and Waste Removal

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site periodically or weekly and dispose of off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.8  Final Cleaning

A. Execute final cleaning of areas affected by the Work prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition using cleaning materials appropriate to the surface and material being cleaned.

D. Clean or replace filters of operating equipment as directed by Engineer.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.9  Starting And Adjusting Of Systems

A. Coordinate schedule for starting and adjusting of various equipment and systems.

B. Notify Engineer and Owner seven days prior to starting and adjusting of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute starting and adjusting under supervision of responsible Contractor's personnel or manufacturer's representative, in accordance with manufacturer's instructions.

G. Adjust operating Products and equipment to ensure smooth and unhindered operation.
H. When specified in individual specifications Section, require manufacturer to provide authorized representative to be present at the site to inspect, check, and approve equipment or system installation prior to starting, and to supervise placing of equipment or system in operation.

I. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

1.10 Demonstration and Instructions

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manuals with Owner's personnel in detail to explain all aspects of operation and maintenance.

D. Demonstrate start-up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled or agreed upon times, at equipment or system location.

E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.11 Testing, Adjusting, And Balancing

A. Submit, for the Owner's approval, the name of an independent firm to perform testing, adjusting, and balancing.

B. The independent firm will perform services specified in individual specifications Sections.

C. Reports will be submitted by the independent firm to the Engineer and the Owner indicating observations and test results, indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

1.12 Protecting Installed Construction

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Repair or replace installed Work damaged by construction operations, as directed by the Engineer.

END OF SPECIFICATION
SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS
A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE
A. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS
A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   4. Provide, erect, and maintain temporary barriers and security devices.
   5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   6. Do not close or obstruct roadways or sidewalks without permit.
   7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
B. Do not begin removal until receipt of notification to proceed from Owner.
C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.
D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.03 EXISTING UTILITIES
A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
B. Protect existing utilities to remain from damage.
C. Do not disrupt public utilities without permit from authority having jurisdiction.
D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS
A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL
A. Remove debris, junk, and trash from site.
B. Leave site in clean condition, ready for subsequent work.
C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION
SECTION 02 82 00
ASBESTOS REMEDIATION

1.0 GENERAL

1.1 Related Documents

A. All of the Contract Documents, including Drawings, General Conditions and other requirements apply to this project.

B. Known hazardous materials related to this project are indicated in the attached reports. The information below is a brief summary of asbestos containing areas and material (see inspection reports for detailed information):
   1. Caulk between metal window frames and brick window openings (all windows throughout except library windows)
   2. Original window glazing and replacement window glazing
   3. Caulk to the unit ventilator louvers
   4. Caulk between brick walls and metal window walls of library windows
   5. Interior of the metal filler panels to the library windows, above main entrance doors, and on select hallway windows
   6. Interior glazing to the metal frame windows

1.2 Asbestos Procedures

A. There is known existing asbestos containing materials (ACM) in the existing building as identified in the attached report. The Contractor shall formally notify each sub-contractor that there are reports included for review.

B. Unknown and inaccessible ACM may be encountered during the project. Where the Contractor encounters discover or encounter ACM during the scope of work the Contractor shall notify the Owner immediately. Action should be taken immediately to reduce, control or eliminate the risk of exposure of contractors and the public to ACM.

C. Responsible Person: The Contractor is required to designate one (1) qualified on-site employee to be in charge of coordination with the project team and the Contractor with regards to the ACM.

D. Responsibility for Hazardous Materials Discovery: It is the sole responsibility of the Contractor and sub-contractors to undertake whatever measures and methods of procedures are necessary to appropriately safeguard the health and safety of all workers and members of the public with respect to any ACM discovery with the project work.

E. Indemnification: To the fullest extent permitted by law, the Contractor and sub-contractor shall indemnify and hold harmless by the Owner and project team and their agents and employees from and against any claims, damages, losses and expenses including, but not limited to, attorney's fees arising out of or relating to an such claim, damage, loss or expense if attributable to bodily injury, sickness, disease or death, or to damage to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and is caused in whole or part by any negligent act or omission of the Contractor and sub-contractor anyone directly or
indirectly employed by any of them or anyone whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

1.3 Lead Containing Surface Coatings and Building Components

A. The Contractor and sub-contractor shall be made aware that Lead Based Paints, other surface coatings, and building components may exist throughout the building. OSHA’s Lead Standard for the Construction Industry, Tile 29 Code of Federal Regulations 1926.62, covers lead in a variety of forms, including metallic lead, all inorganic lead components, and organic lead soaps. OSHA’s lead in construction standard applies to all construction work where an employee may be exposed to lead. All work related to construction, alteration, or repair, including painting, is included. In construction, lead was used in many different types of building component, surfacing, coatings and applications including, but not limited to, roofs, sidings/surfaces, tank linings, and electrical conduits, plumbing fixtures, pipes and waste lines, soft solder, used chiefly for soldering tinfoil and copper pipe joints, is an alloy of lead and tin, paint, varnish, shellac and other surface coating materials. Construction projects vary in their scope and potential for exposing workers to lead and other hazards. Due to the age of the building, it is assumed that there may be lead-containing building materials and surface coatings located within the interior of the building. It is the Contractor’s responsibility to protect their employees from lead exposures and to prevent the release of lead into the environment. Contractor will be responsible to follow all local, state and federal, RI Department of Environmental Management (RIDEM), Occupational and Safety and Health Administration (OSHA), and Environmental Protection Administration rules, regulations and laws concerning lead in construction activities.

B. The Contractor and respective sub-contractors are solely responsible for means and methods and techniques used for demolition.

C. The Contractor and sub-contractor shall at his own cost and expense comply with all laws, ordinance, rules and regulations or Federal, State, Regional and Local authorities during demolition, prepping, sanding, cutting, burning, scraping, paint over, grinding and regarding handling, storing and disposing of demolition/renovation debris.

1.4 Other

A. The Contractor shall be made aware that other hazardous materials may be found inside the building.

2.0 PRODUCTS

Not Applicable

3.0 EXECUTION

Not Applicable

END OF SPECIFICATION
ATTACHMENT A: ASBESTOS MATERIAL REPORT
December 21, 2021

East Providence School Department  
Attn: Mr. Anthony Feola  
145 Taunton Ave.  
East Providence, RI 02914

Re: Limited Asbestos Sampling Report for Exterior Windows and Front Facade at the Riverside Middle School in East Providence, RI.

Mr. Feola:

Enclosed are the analytical results of the asbestos bulk samples collected by Environmental Consulting and Management (ECM) from the exterior windows, louvers and front facade at the Riverside Middle School in East Providence, RI. The inspection consisted of collecting accessible suspect materials in support of the upcoming renovations. Renovation work is slated to impact the exterior windows and front window wall facade.

**Asbestos Report:**

Suspect materials were analyzed for asbestos content utilizing Polarized Light Microscopy (PLM) in accordance with Environmental Protection Agency (EPA) method 600/R-93/116. In addition to collection, location of the samples has also been denoted within this report. Please refer to **Attachment 1** for the analytical results. Below is a chart of the samples collected.

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Material</th>
<th>Location</th>
<th>Asbestos %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A-D</td>
<td>Glazing on aluminum windows</td>
<td>All windows at glass where it insets into aluminum frame.</td>
<td>2% Chrysotile</td>
</tr>
<tr>
<td>2A-C</td>
<td>Caulking around window frames</td>
<td>At window frame where it meets masonry</td>
<td>3-6% Chrysotile</td>
</tr>
<tr>
<td>3A-B</td>
<td>Caulking around louvers</td>
<td>At frame of louver where it meets masonry</td>
<td>6% Chrysotile</td>
</tr>
<tr>
<td>4A-B</td>
<td>Caulking around large front window facade</td>
<td>At frame of window facade where it connects with window frames and at masonry</td>
<td>4% Chrysotile</td>
</tr>
<tr>
<td>5A-C</td>
<td>Metal panels interior insulating material</td>
<td>Window wall in front of building. Panels under and above windows.</td>
<td>None Detected</td>
</tr>
</tbody>
</table>
Asbestos Conclusion:

All windows, louvers and window wall assemblies assessed at the Riverside Middle School contain both asbestos containing caulking and glazing components.

Since the amount of asbestos containing materials is greater than 25 square feet/10 linear feet, an asbestos abatement plan will need to be created and submitted to the RIDOH. Removal of the asbestos containing material will need to be conducted by a RI licensed asbestos abatement contractor.

After the abatement plan is submitted to the RIDOH, the approval process takes approximately 2 to 3 weeks. Once the abatement plan is approved, a letter will be sent out to the building owner with an identification number designated to the project. The approval number is then utilized by the abatement contractor to submit the 10-day notification to the RIDOH, where activities cannot begin until 10 calendar days after the notification is submitted.

Limitations:

As the survey was limited, Environmental Consulting and Management cannot be held responsible for the identification of materials that are hidden, concealed or otherwise inaccessible.

This report was prepared under the request of East Providence Schools. This report should not be represented, reproduced, or disseminated without the written approval of Environmental Consulting and Management or East Providence Schools. No warranties other than those stated in the contract for this project are expressed or implied.

A hard copy of this report can be provided for your records via mail upon request. If you have any further questions feel free to contact myself at 401-304-6614.

Sincerely,
Environmental Consulting & Management

[Signature]
Joseph M. Lepore
ECM Project Manager
RI Inspector No. AI0661
Attachment 2
Asbestos Results
Analysis Report
prepared for
Environmental Consulting & Management Inc

Report Date: 12/21/2021
Project Name: Riverside
Project #: 210773
SanAir ID#: 21076681

NVLAP TESTING
NVLAP LAB CODE 200370-0

10501 Trade Court | North Chesterfield, Virginia  23236
888.895.1177 | 804.897.1177 | fax: 804.897.0070 | IAQ@SanAir.com | SanAir.com
Dear Joseph M. Lepore,

We at SanAir would like to thank you for the work you recently submitted. The 14 sample(s) were received on Tuesday, December 14, 2021 via UPS. The final report(s) is enclosed for the following sample(s): 1A, 1B, 1C, 1D, 2A, 2B, 2C, 3A, 3B, 4A, 4B, 5A, 5B, 5C.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

Sample conditions:
- 14 samples in Good condition.
## Asbestos Bulk PLM EPA 600/R-93/116

<table>
<thead>
<tr>
<th>SanAir ID / Description</th>
<th>Stereoscopic Components</th>
<th>Components</th>
<th>Asbestos Fibers</th>
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<td><strong>SanAir ID / Description</strong></td>
<td><strong>Appearance</strong></td>
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<td><strong>% Non-fibrous</strong></td>
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<tr>
<td>1A / 21076681-001</td>
<td>White</td>
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<td>Other</td>
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<td></td>
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<td></td>
<td>Homogeneous</td>
<td></td>
<td></td>
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<td>Other</td>
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<td></td>
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<tr>
<td></td>
<td>Homogeneous</td>
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<td></td>
</tr>
<tr>
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<td>White</td>
<td>98%</td>
<td>Other</td>
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<td>Other</td>
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<td>97%</td>
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<td>Caulking Around Aluminum</td>
<td>Non-Fibrous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2B / 21076681-006</td>
<td>Brown</td>
<td>94%</td>
<td>Other</td>
</tr>
<tr>
<td>Caulking Around Aluminum</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2C / 21076681-007</td>
<td>Brown</td>
<td>94%</td>
<td>Other</td>
</tr>
<tr>
<td>Caulking Around Aluminum</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3A / 21076681-008</td>
<td>Tan</td>
<td>94%</td>
<td>Other</td>
</tr>
<tr>
<td>Caulking Around Louvec's</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3B / 21076681-009</td>
<td>Tan</td>
<td>94%</td>
<td>Other</td>
</tr>
<tr>
<td>Caulking Around Louvec's</td>
<td>Non-Fibrous</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4A / 21076681-010</td>
<td>Tan</td>
<td>96%</td>
<td>Other</td>
</tr>
<tr>
<td>Caulk Around Large Front</td>
<td>Non-Fibrous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>Homogeneous</td>
<td></td>
<td></td>
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### Asbestos Bulk PLM EPA 600/R-93/116

<table>
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<tr>
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<th>Stereoscopic Appearance</th>
<th>Components</th>
<th>Asbestos Fibers</th>
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<td>4% Chrysotile</td>
</tr>
<tr>
<td>Caulk Around Large Front Windows</td>
<td>Non-Fibrous Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5A / 21076681-012</td>
<td>Various</td>
<td>100% Other</td>
<td>None Detected</td>
</tr>
<tr>
<td>Insulation Inside Metal Panel</td>
<td>Non-Fibrous Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5B / 21076681-013</td>
<td>Various</td>
<td>100% Other</td>
<td>None Detected</td>
</tr>
<tr>
<td>Insulation Inside Metal Panel</td>
<td>Non-Fibrous Homogeneous</td>
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<td></td>
</tr>
<tr>
<td>5C / 21076681-014</td>
<td>Various</td>
<td>100% Other</td>
<td>None Detected</td>
</tr>
<tr>
<td>Insulation Inside Metal Panel</td>
<td>Non-Fibrous Homogeneous</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analyst: Vaughan, Nathaniel

Analysis Date: 12/21/2021

Approved Signatory: 

Date: 12/21/2021
Disclaimer

This report is the sole property of the client named on the SanAir Technologies Laboratory chain-of-custody (COC). Results in the report are confidential information intended only for the use by the customer listed on the COC. Neither results nor reports will be discussed with or released to any third party without our client's written permission. The final report shall not be reproduced except in full without written approval of the laboratory to assure that parts of the report are not taken out of context. The information provided in this report applies only to the samples submitted and is relevant only for the date, time, and location of sampling. The accuracy of the results is dependent upon the client's sampling procedure and information provided to the laboratory by the client. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample(s) in the condition in which they arrived at the laboratory and information provided by the client on the COC, such as: project number, project name, collection dates, po number, special instructions, samples collected by, sample numbers, sample identifications, sample type, selected analysis type, flow rate, total volume or area, and start stop times that may affect the validity of the results in this report. Samples were received in good condition unless otherwise noted on the report. SanAir assumes no responsibility or liability for the manner in which the results are used or interpreted. This report does not constitute and shall not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any other U.S. governmental agencies and may not be certified by every local, state, and federal regulatory agencies.

Samples are held for a period of 60 days. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations.

For NY state samples, method EPA 600/M4-82-020 is performed.

NYELAP Disclaimer:
Polarized-light microscopy is not consistently reliable in detecting asbestos in floor covering and similar non-friable organically bound materials. Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing.

Asbestos Certifications
NVLAP lab code 200870-0
City of Philadelphia: ALL-460
PA Department of Environmental Protection Number: 68-05397
California License Number: 2915
Colorado License Number: AL-23143
Connecticut License Number: PH-0105
Massachusetts License Number: AA000222
Maine License Number: LB-0075, LA-0084
New York ELAP lab ID: 11983
Rhode Island License Number: PCM00126, PLM00126, TEM00126
Texas Department of State Health Services License Number: 300440
Commonwealth of Virginia 3333000323
Washington State License Number: C989
West Virginia License Number: LT000616
Vermont License: AL166318
Louisiana Department of Environmental Quality: 212253, Cert 05088

Revision Date: 8/14/2020
### Special Instructions

<table>
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<th>Volume or Area</th>
<th>Sample Date</th>
<th>Flow Rate*</th>
<th>Start – Stop Time*</th>
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<tbody>
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<td></td>
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</tr>
<tr>
<td>IB</td>
<td></td>
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</tr>
<tr>
<td>2B</td>
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<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>3B</td>
<td></td>
<td></td>
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</tr>
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<td></td>
</tr>
<tr>
<td>5A</td>
<td>Insulation inside metal panels</td>
<td></td>
<td></td>
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</tr>
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</table>

Relinquished by: 📝 [Signature]  12/13/2021  Time: 10:00am

If no technician is provided, then the primary contact for your account will be selected. Unless scheduled, the turnaround time for all samples received after 3 pm EST Friday will begin at 8 am Monday morning. Weekend or holiday work must be scheduled ahead of time and is charged for rush turnaround time. SanAir covers Standard Overnight FedEx shipping. Shipments billed to SanAir with a faster shipping rate will result in additional charges.
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<th>Sample Date</th>
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<td>5C</td>
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</table>

**Special Instructions**

If no technician is provided, then the primary contact for your account will be selected. Unless scheduled, the turnaround time for all samples received after 3 pm EST Friday will begin at 8 am Monday morning. Weekend or holiday work must be scheduled ahead of time and is charged for rush turnaround time. SanAir covers Standard Overnight FedEx shipping. Shipments billed to SanAir with a faster shipping rate will result in additional charges.
December 12, 2022

East Providence School Department
Mr. Chris Murphy
1998 Pawtucket Avenue
East Providence, RI 02914

Re: ECM Project #220695
Riverside Middle School
179 Forbes Street
Riverside, RI 02915
Limited Asbestos Inspection Report

Dear Mr. Murphy:

Enclosed are the analytical results, observations, and recommendations associated with the limited asbestos inspection performed by Environmental Consulting & Management Inc. (ECM) of the windows at Riverside Middle School located at 179 Forbes Street in Riverside, Rhode Island.

Methodology and Scope

On December 1st, 2022 a limited asbestos inspection of the windows at Riverside Middle School was conducted by Mr. Andrew Perreault (Rhode Island Asbestos Inspector Lic. AI00914) of ECM. During the course of the inspection ECM collected samples of accessible suspect asbestos containing building materials (ACBM) that are anticipated to be impacted during the window replacement project. This inspection was conducted according to EPA Asbestos Hazards Emergency Response Act (AHERA) asbestos bulk sampling protocols. The interior and exterior materials of the building, that are anticipated to be impacted by the renovations, were surveyed as part of this inspection. No below grade or sub-slab investigation was conducted as part of this inspection. Destructive investigation to check behind fixed walls and ceilings, under hard finish floor coverings, within wall cavities, and under the facade of building was not conducted as part of this inspection, as the building was still occupied and operational at the time of the inspection. No attempt was made to try to survey this building in its entirety.

181 Amaral Street
Riverside, RI 02915

www.ecmne.com
Asbestos

The survey consisted of collecting suspect ACBM that may be impacted during the window replacement project. These materials are then sent to a Rhode Island licensed asbestos analytical laboratory to be analyzed for asbestos content utilizing Polarized Light Microscopy (PLM) in accordance with Environmental Protection Agency (EPA) method 600/R-93/116. The materials collected, results, location and quantity of ACBM have been denoted within this report. Please refer to Attachment 1 for the asbestos analytical results. Site photographs from the asbestos inspection can be found in Attachment 2. Below is a chart of the samples collected.

Riverside Middle School Window Replacement, Riverside, RI – Asbestos Bulk Sample Results

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Material</th>
<th>Location</th>
<th>Asbestos %</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>01A-C</td>
<td>Caulk Between Metal Window Frame and Brick Facade</td>
<td>Exterior Windows Throughout the Building Except Library</td>
<td>5% Chrysotile</td>
<td>85 Windows 750 SF</td>
</tr>
<tr>
<td>02A-B</td>
<td>Caulk Between Metal Window Frame and Metal Window Sash</td>
<td>Exterior Windows Throughout the Building Except Library</td>
<td>None Detected</td>
<td>NA</td>
</tr>
<tr>
<td>03A-C</td>
<td>Exterior Window Glazing</td>
<td>Exterior Windows Throughout the Building, Exterior Library Window Walls</td>
<td>3% Chrysotile</td>
<td>1,400 SF</td>
</tr>
<tr>
<td>04A-C</td>
<td>Replacement Window Glazing</td>
<td>Exterior Windows Throughout the Building</td>
<td>2% Chrysotile</td>
<td>Included with 03A-C</td>
</tr>
<tr>
<td>05A-C</td>
<td>Unit Ventilator Louver Caulk</td>
<td>Exterior Unit Ventilator Intakes</td>
<td>5% Chrysotile</td>
<td>56 Total 120 SF</td>
</tr>
<tr>
<td>06A-C</td>
<td>White Caulk between Metal Window Wall and Brick</td>
<td>Exterior Library Windows</td>
<td>5% Chrysotile</td>
<td>40 SF</td>
</tr>
<tr>
<td>07A-B</td>
<td>Brick</td>
<td>Exterior Facade</td>
<td>None Detected</td>
<td>NA</td>
</tr>
<tr>
<td>08A-B</td>
<td>Brick Mortar</td>
<td>Exterior Facade</td>
<td>None Detected</td>
<td>NA</td>
</tr>
<tr>
<td>09A</td>
<td>Metal Panel Interior</td>
<td>Exterior Library Windows, Above Main Entry Doors, On Hallway Windows</td>
<td>50% Chrysotile</td>
<td>1,200 SF</td>
</tr>
<tr>
<td>10A-B</td>
<td>2’x4’ Flake Ceiling Tiles</td>
<td>Interior Class Rooms Throughout the Building</td>
<td>None Detected</td>
<td>NA</td>
</tr>
<tr>
<td>11A-B</td>
<td>2’x4’ Track Ceiling Tiles</td>
<td>Interior Class Rooms Throughout the Building</td>
<td>None Detected</td>
<td>NA</td>
</tr>
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<td>12A-B</td>
<td>2’x4’ Solid Ceiling Tiles</td>
<td>Interior Hallways Throughout The Building</td>
<td>None Detected</td>
<td>NA</td>
</tr>
<tr>
<td>13A-B</td>
<td>Interior Window Caulk</td>
<td>Interior Windows Throughout the</td>
<td>&lt;1% Chrysotile</td>
<td>NA</td>
</tr>
<tr>
<td>Sample #</td>
<td>Material</td>
<td>Location</td>
<td>Asbestos %</td>
<td>Quantity</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------------------</td>
<td>----------------</td>
<td>-----------</td>
</tr>
<tr>
<td>14A-B</td>
<td>Interior Window Glazing</td>
<td>Interior Windows Throughout the Building Except Library</td>
<td>3% Chrysotile</td>
<td>1,400 SF</td>
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<tr>
<td>15A-B</td>
<td>Mortar between Window Sills and Window Frame</td>
<td>Interior Windows Throughout the Building Except Library</td>
<td>None Detected</td>
<td>NA</td>
</tr>
<tr>
<td>16A-B</td>
<td>Black Window Sills</td>
<td>Interior Windows Throughout the Building Except Library</td>
<td>None Detected</td>
<td>NA</td>
</tr>
<tr>
<td>17A</td>
<td>Adhesive to Ceramic Wall Tile</td>
<td>Around Windows in Hallways Throughout the Building</td>
<td>&lt;1% Chrysotile</td>
<td>NA</td>
</tr>
</tbody>
</table>

SF – Square Feet   NA – Not Applicable

**Asbestos Conclusion:**

The caulk between the metal window frames and the brick window openings was identified as asbestos containing. This caulk is found on all of the windows throughout the building except the library windows. There are 85 windows with a total of 750 square feet of asbestos containing caulk.

Asbestos was identified in the original window glazing and the replacement window glazing found on the metal frame windows throughout the building. There is a total of 1,400 square feet of asbestos containing window glazing.

ECM identified asbestos containing caulk to the unit ventilator louvers throughout the building. ECM observed 56 unit ventilator louvers with at total of 120 square feet of asbestos containing caulk.

The caulk between the brick walls and metal window walls of the library windows was identified as asbestos containing. There is total of 40 square feet of asbestos containing caulk.

Asbestos was identified in the interior of the metal filler panels to the library windows, above the main entrance doors, and on select windows in the hallways of the schools. There is a total of 1,200 square feet of asbestos containing metal filler panels.

The interior glazing to the metal frame windows throughout the building was identified as asbestos containing. There is a total of 1,400 square feet of asbestos containing window glazing.

The interior window caulk and the adhesive to the ceramic wall tile were both found to contain <1% asbestos. Materials that are found to contain less than 1% asbestos are not a regulated asbestos containing material as defined by the Rhode Island Department of Health (RIDOH) and EPA regulations. However, the Occupational Health and Safety Administration (OSHA) recommends that personal protective equipment be worn when dealing with materials containing any amount of asbestos.
Any suspect materials not sampled within this report should be tested before being impacted.

**Regulatory Compliance**

If the amount of the identified asbestos containing materials to be removed is greater than 3 square feet/3 linear feet, an asbestos abatement plan will need to be prepared and submitted to the Rhode Island Department of Health (RIDOH). Removal of the asbestos containing material will need to be conducted by a RI licensed asbestos abatement contractor.

After the abatement plan is submitted to the RIDOH, the approval process takes approximately 2 to 3 weeks. Once the abatement plan is approved, a letter will be sent out to the building owner with an identification number designated to the project. The approval number is then utilized by the abatement contractor to submit the 10-day notification to the RIDOH, where activities cannot begin until 10 calendar days after the notification is submitted.

A copy of this report should be maintained with the AHERA documents for the school.
Limitations

Components that could affect building operation and endanger the safety of the inspector such as active mechanical or electrical systems were not scrutinized during this inspection unless otherwise noted. Any suspect materials not sampled and tested for the presence of asbestos must be handled and disposed of as if it were unless analytical data can prove otherwise.

This inspection was preformed for a specific scope of work. Should the scope of work change, additional sampling may be required.

This report was prepared under the request of The East Providence School Department. This report should not be represented, reproduced, or disseminated without the written approval of Environmental Consulting and Management or The East Providence School Department. No warranties other than those expressed in the contract for this project are expressed or implied.

A hard copy of this report can be provided for your records via mail upon request. If you have any further questions feel free to contact myself at 401-304-6615.

Sincerely,
Environmental Consulting & Management

Andrew Perreault
Project Manager
RI Asbestos Inspector # AI00914
Attachment 1
Asbestos Bulk Sample Results
Analysis Report
prepared for
Environmental Consulting & Management Inc

Report Date: 12/12/2022
Project Name: Riverside Middle School Window Project
Project #: 220695
SanAir ID#: 22060923
Dear Andrew Perreault,

We at SanAir would like to thank you for the work you recently submitted. The 37 sample(s) were received on Monday, December 05, 2022 via UPS. The final report(s) is enclosed for the following sample(s): 01A, 01B, 01C, 02A, 02B, 03A, 03B, 03C, 04A, 04B, 04C, 05A, 05B, 05C, 06A, 06B, 06C, 07A, 07B, 08A, 08B, 09A, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, 14B, 15A, 15B, 16A, 16B, 17A.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Matthew Daigneault
Asbestos Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

Sample conditions:
- 37 samples in Good condition.
### Asbestos Bulk PLM EPA 600/R-93/116

<table>
<thead>
<tr>
<th>SanAir ID / Description</th>
<th>Stereoscopic</th>
<th>Appearance</th>
<th>Components</th>
<th>Asbestos Fibers</th>
</tr>
</thead>
<tbody>
<tr>
<td>01A / 22060923-001</td>
<td></td>
<td>Grey</td>
<td>% Fibrous</td>
<td>5% Chrysotile</td>
</tr>
<tr>
<td>Caulk Between Metal Frame And Brick/Exterior</td>
<td>Non-Fibrous</td>
<td>95% Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Homogeneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01B / 22060923-002</td>
<td></td>
<td></td>
<td>Not Analyzed</td>
<td></td>
</tr>
<tr>
<td>Caulk Between Metal Frame And Brick/Exterior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01C / 22060923-003</td>
<td></td>
<td></td>
<td>Not Analyzed</td>
<td></td>
</tr>
<tr>
<td>Caulk Between Metal Frame And Brick/Exterior</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>02A / 22060923-004</td>
<td></td>
<td>Grey</td>
<td>100% Other</td>
<td>None Detected</td>
</tr>
<tr>
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</tr>
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<td>3% Chrysotile</td>
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<td></td>
<td></td>
<td>Homogeneous</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>03C / 22060923-008</td>
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<td></td>
<td>Not Analyzed</td>
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</tr>
<tr>
<td>Window Glazing/Exterior</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04A / 22060923-009</td>
<td></td>
<td>Off-White</td>
<td>3% Other</td>
<td>None Detected</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Homogeneous</td>
<td></td>
<td></td>
</tr>
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<td>2% Chrysotile</td>
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<td>Homogeneous</td>
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**Analysis Date:** 12/9/2022

**Approved Signatory:**

**Date:** 12/12/2022
## Asbestos Bulk PLM EPA 600/R-93/116

<table>
<thead>
<tr>
<th>SanAir ID / Description</th>
<th>Stereoscopic Appearance</th>
<th>% Fibrous</th>
<th>% Non-fibrous</th>
<th>Asbestos Fibers</th>
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<tbody>
<tr>
<td>04C / 22060923-011</td>
<td>Replacement Window Glazing/Exterior</td>
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<tr>
<td>05A / 22060923-012</td>
<td>Unit Vent Louver Caulk/Exterior</td>
<td>Tan</td>
<td>95%</td>
<td>5%</td>
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<tr>
<td>05C / 22060923-014</td>
<td>Unit Vent Louver Caulk/Exterior</td>
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<tr>
<td>06A / 22060923-015</td>
<td>Library Windows/Exterior</td>
<td>Grey</td>
<td>95%</td>
<td>5%</td>
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<tr>
<td>06B / 22060923-016</td>
<td>Library Windows/Exterior</td>
<td>Non-Fibrous Homogeneous</td>
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<tr>
<td>06C / 22060923-017</td>
<td>Library Windows/Exterior</td>
<td></td>
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<tr>
<td>07A / 22060923-018</td>
<td>Brick/Exterior</td>
<td>Brown</td>
<td>100%</td>
<td>None</td>
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<tr>
<td>07B / 22060923-019</td>
<td>Brick/Exterior</td>
<td>Non-Fibrous Homogeneous</td>
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<tr>
<td>08A / 22060923-020</td>
<td>Brick Mortar/Exterior</td>
<td>Grey</td>
<td>100%</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Fibrous Homogeneous</td>
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## Asbestos Bulk PLM EPA 600/R-93/116

<table>
<thead>
<tr>
<th>SanAir ID / Description</th>
<th>Stereoscopic Appearance</th>
<th>Components</th>
<th>% Fibrous</th>
<th>% Non-fibrous</th>
<th>Asbestos Fibers</th>
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<tbody>
<tr>
<td>08B / 22060923-021 Brick Mortar/Exterior</td>
<td>Grey Non-Fibrous Homogeneous</td>
<td></td>
<td>100% Other</td>
<td></td>
<td>None Detected</td>
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<tr>
<td>09A / 22060923-022 Metal Panel Interior/Exterior Library</td>
<td>Grey Fibrous Heterogeneous</td>
<td>1% Cellulose</td>
<td>49% Other</td>
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<td>50% Chrysotile</td>
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<tr>
<td>10A / 22060923-023 2'x4' Flake Ceiling Tile/Room 228</td>
<td>Beige Fibrous Heterogeneous</td>
<td>45% Cellulose 15% Min. Wool</td>
<td>40% Other</td>
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<td>None Detected</td>
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<tr>
<td>10B / 22060923-024 2'x4' Flake Ceiling Tile/Room 119</td>
<td>Beige Fibrous Heterogeneous</td>
<td>45% Cellulose 10% Min. Wool</td>
<td>45% Other</td>
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<td>None Detected</td>
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<tr>
<td>11A / 22060923-025 2'x4' Track Ceiling Tile/Room 220</td>
<td>Beige Fibrous Heterogeneous</td>
<td>30% Cellulose 30% Min. Wool</td>
<td>40% Other</td>
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<td>None Detected</td>
</tr>
<tr>
<td>11B / 22060923-026 2'x4' Track Ceiling Tile/Room 217</td>
<td>Beige Fibrous Heterogeneous</td>
<td>30% Cellulose 30% Min. Wool</td>
<td>40% Other</td>
<td></td>
<td>None Detected</td>
</tr>
<tr>
<td>12A / 22060923-027 2'x4' Solid Ceiling Tile/1st Floor Hallway</td>
<td>Beige Fibrous Heterogeneous</td>
<td>30% Cellulose 30% Min. Wool</td>
<td>40% Other</td>
<td></td>
<td>None Detected</td>
</tr>
<tr>
<td>12B / 22060923-028 2'x4' Solid Ceiling Tile/2nd Floor Hallway</td>
<td>Beige Fibrous Heterogeneous</td>
<td>30% Cellulose 30% Min. Wool</td>
<td>40% Other</td>
<td></td>
<td>None Detected</td>
</tr>
<tr>
<td>13A / 22060923-029 Interior Window Caulk/Room 111</td>
<td>White Non-Fibrous Homogeneous</td>
<td>2% Other</td>
<td>98% Other</td>
<td></td>
<td>None Detected</td>
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<tr>
<td>13B / 22060923-030 Interior Window Caulk/Office</td>
<td>Grey Non-Fibrous Homogeneous</td>
<td>3% Other</td>
<td>97% Other</td>
<td></td>
<td>&lt; 1% Chrysotile</td>
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### Asbestos Bulk PLM EPA 600/R-93/116

<table>
<thead>
<tr>
<th>SanAir ID / Description</th>
<th>Stereoscopic Appearance</th>
<th>% Fibrous</th>
<th>% Non-fibrous</th>
<th>Asbestos Fibers</th>
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<tr>
<td>14A / 22060923-031</td>
<td>Black Non-Fibrous Homogeneous</td>
<td>&lt; 1% Other</td>
<td>97% Other</td>
<td>3% Chrysotile</td>
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<tr>
<td>15A / 22060923-033</td>
<td>Grey Non-Fibrous Homogeneous</td>
<td>100% Other</td>
<td>None Detected</td>
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<tr>
<td>15B / 22060923-034</td>
<td>Grey Non-Fibrous Homogeneous</td>
<td>100% Other</td>
<td>None Detected</td>
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<tr>
<td>16A / 22060923-035</td>
<td>Black Non-Fibrous Homogeneous</td>
<td>100% Other</td>
<td>None Detected</td>
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<tr>
<td>16B / 22060923-036</td>
<td>Black Non-Fibrous Homogeneous</td>
<td>100% Other</td>
<td>None Detected</td>
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<tr>
<td>17A / 22060923-037</td>
<td>Grey Non-Fibrous Homogeneous</td>
<td>100% Other</td>
<td>&lt; 1% Chrysotile</td>
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</table>

Project Number: 220695  
P.O. Number:  
Project Name: Riverside Middle School Window Project  
Collected Date: 12/1/2022  
Received Date: 12/5/2022 10:35:00 AM
Disclaimer

The final report cannot be reproduced, except in full, without written authorization from SanAir. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations. The accuracy of the results is dependent upon the client’s sampling procedure and information provided to the laboratory by the client. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample and information provided by the client. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Samples are held for a period of 60 days.

For NY state samples, method EPA 600/M4-82-020 is performed.

Polarized-light microscopy is not consistently reliable in detecting asbestos in floor covering and similar non-friable organically bound materials. Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing.

Asbestos Certifications NVLAP lab code 600227-0
Rhode Island Certification Number: PLM00144
Company: ECM Inc.
Address: 181 Amaral Street
City, St, Zip: Riverside, RI 02915
State of Collection: RI
Bulk: ABB PLM EPA 600/R-93/116
Positve Stop
ABEPA PLM EPA 400 Point Count
ABBIK PLM EPA 1000 Point Count
ABBEN PLM EPA NOB**
ABBCHE TEM Chatfield**
ABBTM TEM EPA NOB**
ABQ PLM Qualitative
○** Available on 24-hr. to 5-day TAT

Air: ABA PCNIOSH 7400
ABA-2 OSHA w/ TWA*
ABTEM TEM AHERA
ABATM TEM NIOSH 7402
ABT2 TEM Level II
Other:

Soil: ABSE PLM EPA 600/R-93/116 (Qual.)

Vermiculite & Soil: ABSP PLM CARB 435 (LOD <1%)
ABSP1 PLM CARB 435 (LOD 0.25%)
ABSP2 PLM CARB 435 (LOD 0.1%)

Dust: ABWA TEM Wipe ASTM D-6480
ABDMV TEM Microvac ASTM D-5755

Water: ABHE EPA 100.2

New York ELAP: PLM NY PLM EPA 600/M4-82-020
ABEPA2 NY ELAP 198.1
ABENY NY ELAP 198.6 PLM NOB
ABBNY NY ELAP 198.4 TEM NOB

Turn Around Times
3 HR (4 HR TEM) □ 6 HR (8HR TEM) □ 12 HR □ 24 HR □
□ 2 Days □ 3 Days □ 4 Days □ 5 Days

Special Instructions
Sample # Sample Identification/Location Volume or Area Sample Date Flow Rate* Start – Stop Time*
01A Caulk Between Metal Frame and Brick / Exterior
01B Caulk Between Metal Frame and Brick / Exterior
01C Caulk Between Metal Frame and Brick / Exterior
02A Caulk Between Metal Support and Metal Frame / Exterior
02B Caulk Between Metal Support and Metal Frame / Exterior
03A Window Glazing / Exterior
03B Window Glazing / Exterior
03C Window Glazing / Exterior
04A Replacement Window Glazing / Exterior
04B Replacement Window Glazing / Exterior
04C Replacement Window Glazing / Exterior
05A Unit Vent Louver Caulk / Exterior

Relinquished By: L. Miller Date: 12/2/22 Time: 7:50AM Received by: PM Date: 12/22/22 Time: 10:55AM

Page 1 of 2
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Sample Identification/Location</th>
<th>Volume or Area</th>
<th>Sample Date</th>
<th>Flow Rate*</th>
<th>Start – Stop Time*</th>
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<td>05B</td>
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<td>Unit Vent Louver Caulk / Exterior</td>
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<tr>
<td>06A</td>
<td>White to Library Windows / Exterior</td>
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<td>06B</td>
<td>White to Library Windows / Exterior</td>
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<td></td>
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<tr>
<td>06C</td>
<td>White to Library Windows / Exterior</td>
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<td>08B</td>
<td>Brick Mortar / Exterior</td>
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<td>09A</td>
<td>Metal Panel Interior / Exterior Library</td>
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<tr>
<td>10A</td>
<td>2'x4' Flake Ceiling Tile / Room 228</td>
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<tr>
<td>10B</td>
<td>2'x4' Flake Ceiling Tile / Room 119</td>
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<td>11A</td>
<td>2'x4' Track Ceiling Tile / Room 220</td>
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<td>2'x4' Track Ceiling Tile / Room 217</td>
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<tr>
<td>12A</td>
<td>2'x4' Solid Ceiling Tile / 1st Floor Hallway</td>
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<tr>
<td>12B</td>
<td>2'x4' Solid Ceiling Tile / 2nd Floor Hallway</td>
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<tr>
<td>13A</td>
<td>Interior Window Caulk / Room 111</td>
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<td>13B</td>
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<td>14B</td>
<td>Interior Window Glazing / Room 119</td>
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<tr>
<td>15A</td>
<td>Mortar Between Window Sill and Frame / Room 220</td>
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<tr>
<td>15B</td>
<td>Mortar Between Window Sill and Frame / Room 119</td>
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<tr>
<td>16A</td>
<td>Window Sill / 2nd Floor Stairwell</td>
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<td>16B</td>
<td>Window Sill / Room 119</td>
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<td>17A</td>
<td>Adhesive to Ceramic Wall Tile / 1st Fl Hallway</td>
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**Special Instructions**

If no technician is provided, then the primary contact for your account will be selected. Unless scheduled, the turnaround time for all samples received after 3 pm EST Friday will begin at 8 am Monday morning. Weekend or holiday work must be scheduled ahead of time and is charged for rush turnaround time. SanAir covers Standard Overnight FedEx shipping. Shipments billed to SanAir with a faster shipping rate will result in additional charges.
Attachment 2
Site Photographs
<table>
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<tbody>
<tr>
<td>Close up of Caulk</td>
<td>Close up of Glazing</td>
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</tbody>
</table>
SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Formed steel stud exterior wall framing.
B. Exterior wall sheathing.

1.02 RELATED REQUIREMENTS
A. Section 06 10 00 - Rough Carpentry: Blocking and wall sheathing.
B. Section 09 21 16 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.
C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS
A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
D. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2018, with Editorial Revision.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Design data:
D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Metal Framing:
   1. CEMCO: www.cemcosteel.com/#sle.

B. Framing Connectors and Accessories:
   1. Same manufacturer as metal framing.
2.02 FRAMING SYSTEM
A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
B. Design Requirements: Provide completed framing system having the following characteristics:
   1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
   2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
   3. Design Loads: In accordance with applicable codes.
   4. Live load deflection meeting the following, unless otherwise indicated:
      b. Exterior Walls: Maximum horizontal deflection under wind load of 1/180 of span.
   5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
   6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS
A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and Depth: As required to meet specified performance levels.
   2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.
   1. Base Metal: Structural Steel (SS), Grade 33/230.
   2. Gage and Depth: As indicated on drawings.
C. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch (3.42 mm), and factory punched holes and slots.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 FASTENERS
A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
B. Anchorage Devices: Powder actuated.

2.05 WALL SHEATHING
A. Gypsum Board Wall Sheathing: See Section 09 21 16.

2.06 ACCESSORIES
A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that substrate surfaces are ready to receive work.
3.02 INSTALLATION OF STUDS
   A. Install components in accordance with manufacturers’ instructions and ASTM C1007 requirements.
   B. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
   C. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
   D. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

3.03 INSTALLATION OF WALL SHEATHING
   A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
      1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.

END OF SECTION
SECTION 05 50 00  
METAL FABRICATIONS

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Steel angle sections mounted to existing columns at curtain wall.
B. Aluminum column enclosures, window sills, and aluminum base trim at curtain walls.
C. Aluminum expansion joint covers.
D. Aluminum ceiling fascia.

1.02  RELATED REQUIREMENTS

1.03  REFERENCE STANDARDS


1.04  SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.

PART 2  PRODUCTS

2.01  MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.
B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02  MATERIALS - ALUMINUM

A. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

2.03  FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04  FABRICATED ITEMS

A. Aluminum column enclosures, window sills and base trim as shown on drawings. Color to match curtain wall.
B. Aluminum ceiling fascia as shown on A-650. Color to match ceiling color.
C. Aluminium expansion joint covers. Color to match windows frames.
D. Continuous steel angle sections mounted to existing columns at curtain wall. Curtain wall slotted deflection clip attached to curtain wall posts and continuous angle.

2.05 FINISHES - STEEL
   A. Prime paint steel items.
   B. Prime Painting: One coat.

2.06 FINISHES - ALUMINUM
   A. Exterior Aluminum Surfaces: Class I color anodized.
   B. Interior Aluminum Surfaces: high performance organic coating.
   C. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

2.07 FABRICATION TOLERANCES
   A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
   B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
   C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
   D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
   E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION
   A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION
   A. Install items plumb and level, accurately fitted, free from distortion or defects.
   B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
   C. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION
SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Sheathing.
B. Preservative treated wood materials.
C. Miscellaneous framing and sheathing.
D. Concealed wood blocking, nailers, and supports.
E. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS
A. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles.
B. Section 07 62 00 - Sheet Metal Flashing and Trim: Drip flashings.
C. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS
J. PS 1 - Structural Plywood; 2009 (Revised 2019).
L. SPIB (GR) - Grading Rules; 2014.
M. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2018.
N. WWPA G-5 - Western Lumber Grading Rules; 2021.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials and application instructions.
C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 QUALITY ASSURANCE
A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
   1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
B. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

1.06 DELIVERY, STORAGE, AND HANDLING
A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS
A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
B. Lumber fabricated from old growth timber is not permitted.
C. Provide sustainably harvested wood.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
B. Sizes: Nominal sizes as indicated on drawings, S4S.
C. Moisture Content: S-dry or MC19.
D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.
E. Miscellaneous Blocking, Furring, Nailers, and Curbs:
   1. Lumber: S4S, No. 1 or Construction Grade.

2.03 CONSTRUCTION PANELS
A. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant (16 mm Type X fire resistant).

2.04 ACCESSORIES
A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M; or Stainless Steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT
A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Manufacturers:
      d. Substitutions: Not permitted.

C. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Treat lumber in contact with roofing, flashing, or waterproofing.
   3. Treat lumber in contact with masonry or concrete.
   4. Treat lumber less than 18 inches (450 mm) above grade.
      a. Treat lumber in other locations as indicated.
   5. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
      a. Kiln dry plywood after treatment to maximum moisture content of 15 percent.
      b. Treat plywood in contact with masonry or concrete.
      c. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL
   A. Select material sizes to minimize waste.
   B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
   C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 FRAMING INSTALLATION
   A. Select material sizes to minimize waste.
   B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
   C. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
   D. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
   E. Install structural members full length without splices unless otherwise specifically detailed.
   F. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

3.03 BLOCKING, NAILERS, AND SUPPORTS
   A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
   B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.
   1. Place water-resistant barrier horizontally over wall sheathing, weather lapping edges and ends.

3.06 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.
C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 78 39.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION
SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Poplar trim boards at window heads.
B. Wood Cap at library steel angle. Wood type and finish to match existing wood finish.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordinate the work with installation of associated and adjacent components.
B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data:
   1. Provide manufacturer’s product data, storage and handling instructions for factory-fabricated units.
C. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS
A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI Architectural Woodwork Standards for Premium Grade.
B. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Painted and/or Stained. Color TBD.

2.02 WOOD-BASED COMPONENTS
A. Wood fabricated from old growth timber is not permitted.
B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 60 00.
C. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless otherwise noted, provided it is clean and free of contamination; identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

2.03 ACCESSORIES
A. Lumber for Shimming

2.04 WOOD TREATMENT
A. Shims/Blocking - Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

2.05 FABRICATION
A. Shop assemble work for delivery to site, permitting passage through building openings.
B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify adequacy of backing and support framing.

**3.02 INSTALLATION**

A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim to conceal larger gaps.

**3.03 TOLERANCES**

A. Maximum Variation from True Position: 1/16 inch (1.5 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.7 mm).

**END OF SECTION**
SECTION 06 61 00
CAST POLYMER FABRICATIONS

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Solid Surface Window Stools

1.02 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Include color, pattern, and material properties.
   C. Samples: Submit two samples representative of window stool, 8 x 8 inch (203.2 x 203.2 mm) in size, illustrating color, texture, and finish.

PART 2 PRODUCTS
2.01 MATERIALS
   A. Solid Surfacing:
      1. Applications: Window Stool
      2. Materials: Homogeneous compression-molded material composed of quartz; manufactured into sheets.
      4. See drawings for substrate and dropped edge detail. Sill depth called out on A-650 _ Window Types.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that joint preparation and affected dimensions are acceptable.

3.02 INSTALLATION
   A. Install components in accordance with approved shop drawings and manufacturer's instructions.
   B. Align work plumb and level.
   C. Rigidly anchor to substrate to prevent misalignment.

3.03 TOLERANCES
   A. Maximum Variation From True Dimension: 1/8 inch (3 mm).
   B. Maximum Offset From True Position: 1/8 inch (3 mm).

3.04 CLEANING
   A. Clean and polish surfaces in accordance with manufacturer's instructions.

3.05 PROTECTION
   A. Protect installed window stools from subsequent construction operations.

END OF SECTION
SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Self-adhered modified bituminous sheet membrane.
   B. Air and vapor barrier sheet membrane.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
   B. Product Data: Provide data for membrane.

1.04 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 MOCK-UPS
   A. See Section 01 40 00 - Quality Requirements for additional requirements.
   B. Construct mock-up consisting of 100 sq ft (10 sq m) of horizontal and vertical sheet waterproofing panel; to represent finished work including internal and external corners, seam jointing, attachment method, and drainage panel.
   C. Locate where directed.
   D. Mock-up may remain as part of work.

1.06 WARRANTY
   A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
   B. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING APPLICATIONS
   A. Self-Adhered Modified Bituminous Sheet Membrane:
      1. Location: Curtain wall sills and membrane flashing.
   B. Air and vapor barrier Sheet Membrane:
      1. Location: Over exterior sheathing.

2.02 SHEET WATERPROOFING MATERIALS
   A. Self-Adhered Modified Bituminous Sheet Membrane:
      1. Thickness: 40 mil, 0.04 inch (1.02 mm), minimum.
      2. Sheet Width: 36 inches (0.914 m), minimum.
      3. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   B. Air and Vapor Barrier Sheet Membrane: HDPE dampproofing sheet dimpled in regular pattern to provide continuous minimum air gap of nominal 1/4 inch (6 mm).
      1. Sheet Thickness: 20 mil, 0.02 inch (0.51 mm), minimum.
      2. Sheet Width: Maximum available to minimize seams.
   C. Air and Vapor Barrier Sheet Membrane:
1. Product: GCP - Vycor enV-S or equal.

2.03 ACCESSORIES
   A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions are acceptable prior to starting work.
   B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
   C. Verify that items penetrating surfaces to receive waterproofing are securely installed.
   D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
   E. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 PREPARATION
   A. Protect adjacent surfaces from damage not designated to receive waterproofing.
   B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
   C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
   D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.
   E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.

3.03 INSTALLATION - MEMBRANE
   A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
   B. Roll out membrane, and minimize wrinkles and bubbles.
   C. Mechanically Fastened Membrane: Install mechanical fasteners in accordance with manufacturer's instructions, and bond sheet to membrane discs.
   D. Overlap edges and ends, minimum 3 inches (76 mm), seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
   E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
   F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
   G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
   H. Seal membrane and flashings to adjoining surfaces.

3.04 FIELD QUALITY CONTROL
   A. See Section 01 40 00 - Quality Requirements for additional requirements.

END OF SECTION
SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Board insulation at exterior wall in soffit cavity.
   B. Batt insulation and vapor retarder in exterior wall construction.

1.02 RELATED REQUIREMENTS
   A. Section 06 10 00 - Rough Carpentry: Supporting construction for batt insulation.
   B. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
   A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
   C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
   D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS
   A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.06 SEQUENCING
   A. Sequence work to ensure fireproofing, firestop, and vapor retarder materials are in place before beginning work of this section.

1.07 COORDINATION
   A. Coordinate the work with spray foam closed cell insulation application.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Insulation:
   1. Dow
   2. Owens Corning
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS

A. Insulation Over Metal Stud Framed Walls, Continuous: Extruded polystyrene (XPS) board.
B. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

2.03 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: ASTM C 578, Type IV; Extruded polystyrene board with natural skin surfaces; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
   3. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   4. Board Size: 48 x 96 inch (1220 x 2440 mm) or 24 X 96 inch.
   5. Board Thickness: 2 inches (50 mm).
   6. Board Edges: Square, Shiplap or Tongue and groove.
   7. Thermal Conductivity (k factor) at 75 degrees: or 0.18 (0.31).
   8. Compressive Resistance: 25 psi (173 kPa) and 40 psi.
   9. Board Density: 1.8 lb/cu ft (29 kg/cu m).
   10. Water Absorption, maximum: 0.1 percent, volume.

B. Manufacturers:
   1. Dow Chemical Co(Design Basis):
      a. Cavity Wall - "Cavity Mate Plus", type IV
      b. Foundation and slabs - "Styrofoam Highload 40" type VI.
   2. Owens Corning Corp.
      a. Cavity Wall - "Foamular 250", type IV
      b. Foundation and Slabs - "Foamular 400 SE", type VI.
   3. Pactiv Building Products
      a. Cavity Wall - "Green Board Score Board", type IV
      b. Foundation and Slabs - Type VI.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 BATT INSULATION MATERIALS

A. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
   1. Material: Rock or slag fiber, or glass fiber.
   2. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   3. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
   4. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
   5. Formaldehyde Content: Zero.
   7. Facing: Aluminum foil, flame spread 25 rated; one side.
   8. Manufacturers:

9. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Tape: Bright aluminum; Polyethylene or Polyester self-adhering type, mesh reinforced, 2 inch (50 mm) wide.
B. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

D. Adhesive: Type recommended by insulation manufacturer for application and in compliance with Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of irregularities or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inch (150 mm) wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints.
   2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
   2. Full bed 1/8 inch (3 mm) thick.

C. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

D. Install with factory applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

F. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

G. Tape seal tears or cuts in vapor retarder.

H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

I. Coordinate work of this section with construction of air barrier seal specified in Section 07 27 26.
3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION
SECTION 07 91 00
PREFORMED JOINT SEALS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Precompressed foam seals at expansion joints.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Precompressed Foam Seals:
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PRECOMPRESSED FOAM SEALS
A. Precompressed Foam Seal: Comprised of urethane, modified-acrylic impregnated, open-cell polyurethane, or closed-cell neoprene foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.
   2. Size as required to provide water-tight seal when installed.
   3. Provide Emseal Seismic Colorseal - DS, or equal.
   4. Applications:
      a. Exterior wall expansion joints.

2.03 ACCESSORIES
A. Adhesive: As recommended by seal manufacturer.
B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that joints are ready to receive this work.
B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 INSTALLATION
A. Install in accordance with manufacturer's written instructions.
B. Precompressed Foam Seals:
   1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
   2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
   3. Remove loose materials and foreign matter that could impair adhesion of sealant.
   4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

END OF SECTION
SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Nonsag gunnable joint sealants.
B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
1.04 QUALITY ASSURANCE

A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver to manufacturer sufficient samples for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

B. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

C. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
   1. Repair failed portions of joints.

D. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Correct defective work within a five year period after Date of Substantial Completion.
C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
2.03 JOINT SEALANTS - GENERAL
   A. Colors: As indicated on drawings.

2.04 NONSAG JOINT SEALANTS
   A. Type A - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
      2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
      3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   B. Type B - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
      2. Color: Match adjacent finished surfaces.

2.05 ACCESSORIES
   A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
      1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
      2. Open Cell: 40 to 50 percent larger in diameter than joint width.
   B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
   C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
   D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
   E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that joints are ready to receive work.
   B. Verify that backing materials are compatible with sealants.
   C. Verify that backer rods are of the correct size.

3.02 PREPARATION
   A. Remove loose materials and foreign matter that could impair adhesion of sealant.
   B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
   C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
   D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION
   A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
   B. Perform installation in accordance with ASTM C1193.
   C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
   D. Install bond breaker backing tape where backer rod cannot be used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION
SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Non-fire-rated exterior insulated hollow metal doors and frames.
B. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS
A. Section 08 44 13 - Glazed Aluminum Curtain Wall for Insulated aluminum panels.
B. Section 08 71 00 - Door Hardware.
C. Section 09 91 13 - Exterior Painting: Field painting.
D. Section 09 91 23 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS
D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2020.
E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
J. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2016.
M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Hollow Metal Doors and Frames:
   2. Curries, an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS
A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM
A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.

3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.

4. Door Edge Profile: Manufacturers standard for application indicated.

5. Typical Door Face Sheets: Flush.

6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 2 - Seamless.
   d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
   e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

3. Top Closures for Outswinging Doors: Flush with top of faces and edges.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Knock-down type.

1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.

2. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.

3. Weatherstripping: Separate, see Section 08 71 00.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws for metal panel transom.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.
3.02 PREPARATION
   A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION
   A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
   B. Coordinate frame anchor placement with wall construction.
   C. Install door hardware as specified in Section 08 71 00.

3.04 TOLERANCES
   A. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING
   A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE
   A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION
SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Aluminum doors into curtain wall system.
   B. Infill panels of glass.
   C. Weatherstripping.
   D. Door hardware.

1.02 RELATED REQUIREMENTS
   A. Section 08 44 13 - Glazed Aluminum Curtain Walls.
   B. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
   C. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS
   A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

1.04 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
   B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
   C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
   D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
   E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
   F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

1.05 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
   B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Handle products of this section in accordance with AAMA CW-10.
   B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.
1.07 FIELD CONDITIONS
A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
   Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY
A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units,
   including interpane dusting or misting. Include provision for replacement of failed units.
C. Provide five year manufacturer warranty against excessive degradation of exterior finish.
   Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Aluminum-Framed Storefronts:
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BASIS OF DESIGN -- SWINGING DOORS
A. Entrance Doors:
   2. Thickness: 2-1/4" inches (57.2 mm).
B. Wide Stile, Insulating Glazing, Thermally-Broken:
   2. Thickness: 2-1/4 inches (57.1 mm).
C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent
   product of another manufacturer.
D. Substitutions: See Section 01 60 00 - Product Requirements.
   1. For any product not identified as "Basis of Design", submit information as specified for
      substitutions.

2.03 COMPONENTS
A. Glazing: See Section 08 80 00.
B. Swing Doors: Glazed aluminum.
   1. Thickness: 2-1/4" inches (57.1 mm).
   2. Top Rail: 5 inches (127 mm) wide.
   3. Vertical Stiles: 5 inches (127 mm) wide.
   4. Bottom Rail: 10 inches (254 mm) wide.
   5. Glazing Stops: Square.
   6. Cross Rail: 6 inches
   7. Finish: Same as storefront.

2.04 MATERIALS
B. Fasteners: Stainless steel.
C. Sealant for Setting Thresholds: Non-curing butyl type.

2.05 FINISHES
A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not
   less than 0.7 mils (0.018 mm) thick.

2.06 HARDWARE
A. For each door, include weatherstripping, sill sweep strip, and threshold.
B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify dimensions, tolerances, and method of attachment with other work.
B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION
A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
I. Set thresholds in bed of sealant and secure.
J. Install hardware using templates provided.
K. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 80 00.
L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES
A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL
A. See Section 01 40 00 - Quality Requirements for general testing and inspection requirements.
B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING
A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING
A. Remove protective material from pre-finished aluminum surfaces.
B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION
SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Aluminum-framed curtain wall, with vision glazing and glass and metal infill panels.
B. Associated louvers and operable sash.

1.02 RELATED REQUIREMENTS
A. Section 05 50 00 - Metal Fabrications: Steel attachment devices.
B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
C. Section 08 43 13 - Aluminum-Framed Storefronts: Entrance doors.
D. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS
A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 MOCK-UPS
A. See Section 01 40 00 - Quality Requirements for additional requirements.
B. Provide 4 x 4 feet (1219.2 x 1219.2 mm) mock-up including each component being used on the project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

C. Locate off-site where directed, and remove when directed.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Handle products of this section in accordance with AAMA CW-10.
B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS
A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY
A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
D. Provide five year manufacturer warranty against excessive degradation of exterior finish.
Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design: Kawneer 1600 UT System 1 Curtain Wall.
B. Other Acceptable - Glazed Aluminum Curtain Walls Manufacturers:
   1. Or Equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CURTAIN WALL
A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside glazed, with pressure plate and mullion cover.
   2. Vertical Mullion Dimensions: 2-1/2" wide x 10-1/2" deep; 2-1/2" wide x 6" deep; & 2-1/2" wide x 7-3/4" deep. See drawings for locations.
   3. Finish: Class I natural anodized.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   4. Provide flush joints and corners, weatherseal, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with RISBC - risk Category II with an ultimate wind speed of 134 MPH.
   2. Provided structural reinforced mullions to comply with mullion depth per drawings.
   3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
      a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
      b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
      c. Movement of curtain wall relative to perimeter framing.
      d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 psf (480 Pa).

D. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.27 psf (300 Pa) pressure difference across assembly.

2.03 COMPONENTS
A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
B. Glazing: See Section 08 80 00.
C. Insulated Infill Panel: Mapes - Mapeshield.
1. Outer Face: 1/8 inch (3 mm) thick Solid Plastic (SPS) exterior substrate with Standard Kynar finish.
2. Impact Resistant Layer
3. Core: 1” Isocyanurate Insulation Core
4. Inner Face: 1/2 inch (12.7 mm) thick cement board with smooth primed aluminum.

2.04 FINISHES
A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install curtain wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
G. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

END OF SECTION
SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Extruded aluminum windows with fixed sash, operating sash, and infill panels.
   B. Operating hardware.
   C. Insect screens.

1.02 RELATED REQUIREMENTS
   A. Section 06 10 00 - Rough Carpentry: Rough opening framing.
   B. Section 06 10 00 - Rough Carpentry: Wood perimeter shims.
   C. Section 07 13 00 - Sheet Waterproofing
   D. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.
   E. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS
   B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Preinstallation Meeting: Convene 2 weeks before starting work of this section.

1.05 SUBMITTALS
   A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
   B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
   C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, anchorage locations, and installation requirements.
   D. Samples:
      1. Framing: Two samples, 12 by 12 inch (300 by 300 mm) in size illustrating typical corner construction, accessories, and finishes.
      2. Sashes: Two samples, 12 by 12 inch (300 by 300 mm) in size illustrating typical corner construction, accessories, and finishes.
      3. Operating Hardware: Two samples of each type and finish.
   E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
      1. Evidence of AAMA Certification.
      2. Evidence of WDMA Certification.
      3. Evidence of CSA Certification.
      4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
   F. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
   G. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
   H. Manufacturer's qualification statement.
I. Installer's qualification statement.
J. Specimen warranty.

1.06 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
   B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Comply with requirements of AAMA CW-10.
   B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.08 FIELD CONDITIONS
   A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

1.09 WARRANTY
   A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
   B. Correct defective work within a 2 year period after Date of Substantial Completion.
   C. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.
   D. Manufacturer Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Basis of Design: Kawneer TR9100 Single Hung with Class 5 Balances and Kawneer 8225 TLF system for Fixed and Hopper window units.
   B. Other Acceptable - Aluminum Windows Manufacturers with proven documentation that meets or exceeds the Basis of Design.
      1. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS
   A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.

2.03 ALUMINUM WINDOWS
   A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
      1. Frame Depth: 3 1/4" inch (83 mm).
      2. Operable Units: Double weatherstripped.
      3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
      4. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
      5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
      6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
B. Fixed, Non-Operable Type:
   2. Glazing: Double; clear; transparent.
   4. Interior Finish: Class I natural anodized.

C. Inswinging Hopper Type:
   2. Provide screens.
   3. Glazing: Hurricane glazing unit; clear; transparent.
   5. Interior Finish: Class I natural anodized.

D. Single Hung Type:
   2. Provide screens.
   3. Glazing: Hurricane glazing unit; clear; transparent.
   5. Interior Finish: Class I natural anodized.

2.04 PERFORMANCE REQUIREMENTS
A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): R.

B. Design Pressure (DP): In accordance with RISBC - Risk Category II with an ultimate wind speed of 134 MPH.

2.05 COMPONENTS
A. Vertical Mullions: 2" wide, 3 1/4" and 4 1/4" wide vertical mullions for 3 1/4" system. All mullions to be thermal broken. See drawings for locations.
B. Receptors: Receptors to be at all head details and masonry jamb detail. Provide 2" wide thermal broken receptors for 3 1/4" TR9100 system and 2 1/4" 8225 TLF system.
C. Horizontal True Muntin: Fixed unit horizontal mullion for metal panel installation.
D. Sills: 2 - piece [6 ga. thick, extruded aluminum; sloped for positive wash to 3/4" inch (19 mm) beyond wall face; one piece full width of opening; jamb angles to terminate sill end.

E. Insulated Infill Panel: Mapes - Mapeshield.
   1. Outer Face: 1/8 inch (3 mm) thick Solid Plastic (SPS) exterior substrate with Standard Kynar finish.
   2. Impact Resistant Layer
   3. Core: 1" Isocyanurate Insulation Core
   4. Inner Face: 1/2 inch (12.7 mm) thick cement board with smooth primed aluminum.

F. Insect Screens: Extruded aluminum frame with mitered and reinforced corners; screen mesh taut and secure to frame; secured to window with adjustable hardware allowing screen removal without use of tools.
   1. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's standard mesh.
   2. Frame Finish: Same as frame and sash.

G. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to achieve effective weather seal.

H. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

I. Provide swivel sash stops at all single hung units.

2.06 HARDWARE
A. Sash lock: Automatically engaged sill locks.
B. Window Opening Control Devices (WOCD): Provide operable window sash hardware that limits openings to only allow passage of 4 inch (102 mm) diameter rigid sphere or less, and are easily releasable to fully open without use of keys, tools, or special knowledge.

C. Limit Stops: Resilient rubber.

2.07 FINISHES
A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 PRIME WINDOW INSTALLATION
A. Install windows in accordance with manufacturer's instructions.
B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
E. Install sill and sill end angles.
F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
G. Install operating hardware not pre-installed by manufacturer.
H. Install glass and infill panels in accordance with requirements; see Section 08 80 00.

3.02 ADJUSTING
A. Adjust hardware for smooth operation and secure weathertight closure.

3.03 CLEANING
A. Remove protective material from factory finished aluminum surfaces.

END OF SECTION
SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Insulating glass units.
B. Glazing units.
C. Glazing compounds.

1.02 RELATED REQUIREMENTS
A. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing provided as part of the aluminum doors.
B. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing provided as part of wall assembly.
C. Section 08 51 13 - Aluminum Windows: Glazing provided by window manufacturer.
D. Section 08 87 23 - Safety and Security Films.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch (305 by 305 mm) in size of glass units.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner’s name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2  PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Wind Loads: Comply with RISBC - Risk Category II with an ultimate wind speed of 134 MPH.

2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer’s published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

2.02 GLASS MATERIALS
   A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

   B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.03 INSULATING GLASS UNITS
   A. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Warm-Edge Spacers: Polypropylene warm-edge technology design.
      a. Spacer Width: As required for specified insulating glass unit.
      b. Spacer Height: Manufacturer's standard.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polysisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
      b. Color: Black.
   6. Purge interpane space with dry air, hermetically sealed.

2.04 GLAZING UNITS
   A. Hurricane Impact Resistance Glazing: Laminated glass, 3-Ply with the design wind loads as stated above.

2.05 ACCESSORIES
   A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II.
      Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
   B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II.
      Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
   C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS
   A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
   B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
3.02 PREPARATION
   A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
   B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
   C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL
   A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
   B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer’s instructions.
   C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
   D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

3.04 CLEANING
   A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
   B. Remove nonpermanent labels immediately after glazing installation is complete.
   C. Clean glass and adjacent surfaces after sealants are fully cured.
   D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer’s written recommendations.

3.05 PROTECTION
   A. After installation, mark pane with an ‘X’ by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
   B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION
SECTION 08 87 23
SAFETY AND SECURITY FILMS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Glazing film applied to existing and new glazing assemblies.
B. New Glazing: Factory or shop install film to glazing before installation in frames.
C. Glazing assemblies to receive film are indicated on drawings.

1.02 RELATED REQUIREMENTS
A. Section 08 51 13 - Aluminum Windows: New windows to receive film.
B. Section 08 80 00 - Glazing: New glazing to received film.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Record of product certification for safety requirements.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.
C. Samples: For each film product to be used, minimum size 4 inches (102 mm) by 6 inches (152 mm), representing actual product, color, and patterns.
D. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.
E. Specimen Warranty.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of safety glazing films with minimum 10 years successful experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

1.07 FIELD CONDITIONS
A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY
A. Provide 10 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. 3M Window Film: www.solutions.3m.com/#sle.
2.02 SAFETY AND SECURITY GLAZING FILM

2.03 MATERIALS

A. Glazing Film: Transparent polyester film for permanent bonding to glass.
   1. Thickness: 0.008 inch (0.2 mm), minimum.
   2. Color: Clear.
   4. Adhesive Type: Pressure sensitive acrylic.

B. Accessory Materials: As recommended or required by film manufacturer.

C. Glass Cleaner: As recommended by glazing film manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field Applied Film: Verify that existing conditions are adequate for proper application and performance of film.

B. Examine glass and frames. Verify that existing conditions are adequate for proper application and performance of film.

C. Verify glass is not cracked, chipped, broken, or damaged.

D. Verify that frames are securely anchored and free of defects.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

C. Protect adjacent surfaces.

D. Do not begin installation until substrates have been properly prepared.

3.03 INSTALLATION

A. Do not apply glazing film when surface temperature is less that 40 degrees F (4 degrees C) or if precipitation is imminent.

B. Install in accordance with manufacturer’s instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.

C. Accurately cut film with straight edges to required sizes allowing 1/16 inch (2 mm) to 1/8 inch (3 mm) gap at perimeter of glazed panel unless otherwise required by anchorage method.

D. Seams: Seam film only as required to accommodate material sizes; form seams vertically without overlaps and gaps; do not install with horizontal seams.

E. Clean glass and anchoring accessories following installation. Remove excess sealants and other glazing materials from adjacent finished surfaces.

F. Remove labels and protective covers.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION
SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Louvers, frames, and accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.
D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.
E. Test Reports: Independent agency reports showing compliance with specified performance criteria.
F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
G. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.04 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.05 WARRANTY
A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
   1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Louvers:
   1. Greenheck - EHH-401
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS
A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

2.03 MATERIALS
2.04 FINISHES
   A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

2.05 ACCESSORIES
   A. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.
   B. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.
   C. Insect Screen: 18 x 16 size aluminum mesh.
   D. Fasteners and Anchors: Stainless steel.
   E. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.
   F. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
   B. Verify that field measurements are as indicated.

3.02 INSTALLATION
   A. Install louver assembly in accordance with manufacturer's instructions.
   B. Install louvers level and plumb.
   C. Set sill members and sill flashing in continuous bead of sealant.
   D. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
   E. Secure louver frames in openings with concealed fasteners.

3.03 ADJUSTING
   A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 CLEANING
   A. Strip protective finish coverings.
   B. Clean surfaces and components.

END OF SECTION
SECTION 09 24 00
CEMENT PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Provide acrylic plaster textured finish system for exterior ceiling surfaces.
B. Provide reveals and control joints to match existing.
C. Provide all required subframing and sheathing for these soffits.

1.02 RELATED REQUIREMENTS
A. Section 05 40 00 - Cold-Formed Metal Framing: Structural metal framing for plaster.
B. Section 06 10 00 - Rough Carpentry: Wood stud framing for plaster.
C. Section 09 91 13 - Exterior Painting.

1.03 REFERENCE STANDARDS
A. ASTM C1177, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
B. Product Data: Provide data on materials and trim accessories.
C. Samples:
   1. Submit two samples, 12 by 12 inch (304.8 by 304.8 mm) in size illustrating finish color and texture.
   2. Submit two samples of each type trim accessory.

1.05 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 MOCK-UPS
A. See Section 01 40 00 - Quality Requirements for additional requirements.
B. Mock-Up Panel: Construct a 2 foot wide by 4 foot high (609.6 mm wide by 1219.2 mm high) sample panel of plaster work at the jobsite demonstrating installation procedures, finish texture, and color. Show each phase of installation including framing and reinforcement.
C. Construct mock-up of exterior ceiling, 2 feet (.6096 m) long by 4 feet (1.2192 m) wide, illustrating surface finish.
   1. Locate where directed.
   2. Mock-up may not remain as part of this work.

1.07 FIELD CONDITIONS
A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F (4 degrees C) or lower, or when temperature is expected to drop below 40 degrees F (4 degrees C) within 48 hours of application.

PART 2 PRODUCTS

2.01 CEMENT PLASTER APPLICATIONS
A. Sheathing: 5/8" DensGlass® glass mat faced gypsum sheathing in compliance with ASTM C1177:
B. Surface Reinforcement : Sto Mesh – nominal 4.5 oz/yd2 (153 g/m2) glass fiber reinforcing mesh treated for compatibility with Sto materials.
C. Base Coat: Sto BTS Xtra – one component polymer modified portland cement extra high build base coat.
D. Primer: StoPrime – acrylic-based smooth primer, complies with SCAQMD Rule 1113 for primers.

2.02 FACTORY PREPARED CEMENT PLASTER
A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.
   1. Provide weather resistive barrier as part of the system, by the same manufacturer.
   2. Manufacturer - Basis of Design: Sto Corp - DEFS for Soffits & Ceilings
   3. Other Acceptable Manufacturers:
      a. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES
A. Metal channels and furring to support assembly.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify existing conditions are acceptable prior to starting this work.
B. Verify sheathing is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

3.02 MIXING
A. Mix only as much plaster as can be used prior to initial set.
B. Mix materials dry, to uniform color and consistency, before adding water.
C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.03 APPLICATION
A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.
B. Base Coats:
   1. Apply base coat(s) to fully embed mesh and to specified thickness.
   2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.
C. Leveling Coat:
   1. Apply leveling coat to specified thickness.
   2. Fully embed reinforcing mesh in leveling coat.
D. Finish Coats:
   1. Cement Plaster:
      a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.
      b. Apply desired surface texture while mix is still workable.
      c. Smooth trowel to a consistent finish.
      d. Aggregate Surfacing: Hand apply to provide full surface coverage.
   2. Primer and Acrylic Coatings:
      a. Remove surface contaminants such as dust and dirt without damaging substrate.
      b. Apply primer in accordance with manufacturer's instructions.
      c. Apply finish coating in number of coats and to thickness recommended by manufacturer.

3.04 TOLERANCES
A. Maximum Variation from True Flatness: 1/8" inch in 10 feet (3.175 mm in 3 m).
3.05 REPAIR

A. Patching: Remove loose, damaged or defective plaster and replace with plaster of same composition; finish to match surrounding area.

END OF SECTION
SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Tile for wall applications.

PART 2 PRODUCTS

2.01 TILE
A. Glazed Wall Tile: ANSI A137.1, standard grade.
   1. Size: 4-1/4 by 4-1/4 inch (108 by 108 mm), nominal.
   2. Edges: Cushioned.
   4. Color(s): To be selected by Architect from manufacturer's standard range.

2.02 SETTING MATERIALS
A. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
   1. Products:
      b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.
      c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
      d. Sika Corp; SikaTile 350 Flex Set: www.sika.com/#sle.

2.03 GROUTS
A. Standard Grout: ANSI A118.6 standard cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Products:
      b. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com/#sle.
      c. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Grout: www.merkrete.com/#sle.
      d. Sika Corp; SikaTile 800 Grout Sanded: www.sika.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

3.02 PREPARATION
A. Protect surrounding work from damage.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL
A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.
B. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

C. Form internal angles square and external angles bullnosed.

D. Sound tile after setting. Replace hollow sounding units.

E. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

F. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

G. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 CLEANING

A. Clean tile and grout surfaces.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS


B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

C. SSPC-SP 2 - Hand Tool Cleaning; 2018.

D. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paints:
   1. PPG Paints: www.ppgpaints.com/#sle.

B. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Supply each paint material in quantity required to complete entire project's work from a single production run.

3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, wood, plaster, uncoated steel, shop primed steel, and galvanized steel.

1. Two top coats and one coat primer.

2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
D. Seal surfaces that might cause bleed through or staining of topcoat.
E. Concrete:
   F. Masonry:
      1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
      2. Prepare surface as recommended by top coat manufacturer.
G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
J. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.
K. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
L. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
M. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces with clear sealer.

3.02 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
D. Sand wood and metal surfaces lightly between coats to achieve required finish.
E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
3.03 SCHEDULE - PAINT SYSTEMS

END OF SECTION
SECTION 09 96 00
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Refinish existing steel lintels at each opening.
   1. High performance coatings.
   2. Surface preparation.

1.02 RELATED REQUIREMENTS
A. Section 09 91 23 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS
A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
D. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
E. SSPC-SP 11 - Power Tool Cleaning to Bare Metal; 2012, with Editorial Revision (2013).

1.04 MOCK-UPS
A. See Section 01 40 00 - Quality Requirements for general requirements for mock-up.
B. Provide mock-up of steel lintel sandblasting prep, prime & top coat, 4 feet (1.2192 m) long by full depth, illustrating coating, for each specified coating.
C. Locate where directed.
D. Mock-up may remain as part of the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. High-Performance Coatings:
   2. Substitutions: Section 01 60 00 - Product Requirements.

2.02 TOP COAT MATERIALS
A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
B. Epoxy Coating for Steel lintels:
   1. Number of coats: Two.
   2. Top Coat(s): Polyamide Epoxy; MPI #77, #177.
      a. Sheen: Gloss.
      b. Products:
C. Shellac: Pure, white type.
2.03 PRIMERS
   A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.
         a. Products:
            1) PPG Paints; Aquapon Zinc Rich Epoxy, 97-670 Series: www.ppgpaints.com/#sle. (MPI #20)
            2) PPG Paints; Amercoat Zinc Rich Epoxy, 68HS Series: www.ppgpaints.com/#sle.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Do not begin application of coatings until substrates have been properly prepared.
   C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
   D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.02 PREPARATION
   A. Clean surfaces of loose foreign matter.
   B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
   C. Remove finish hardware, fixture covers, and accessories and store.
   D. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING
   A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION
   A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.
   B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 FIELD QUALITY CONTROL
   A. See Section 01 40 00 - Quality Requirements for general requirements for field inspection.

END OF SECTION
SECTION 12 24 00
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Interior manual roller shades.

1.02 REFERENCE STANDARDS
B. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.03 ADMINISTRATIVE REQUIREMENTS
A. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field
      conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including
   materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and
   accessories.
C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head,
   jamb and sill details, mounting dimension requirements for each product and condition, and
   operation direction.
D. Source Quality Control Submittals: Provide test reports indicating compliance with specified
   fabric properties.
E. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials,
   color and pattern.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each
   opening.
B. Handle and store shades in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS
A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY
A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Fabric: One year.
   3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROLLER SHADES
A. General:
1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
2. Provide shade system that operates smoothly when shades are raised or lowered.

   1. Description: Single roller, manually operated fabric window shades.
      a. Drop Position: Regular roll.
      b. Mounting: Ceiling mounted.
      c. Size: As indicated on drawings.
      d. Fabric: As indicated under Shade Fabric article.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Material: Steel, 1/8 inch (3 mm) thick.
   3. Roller Tubes:
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
      d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
   5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
      a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
      b. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.
      c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
   6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound (43 kg) minimum breaking strength. Provide upper and lower limit stops.
      a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
   7. Accessories:
      a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
         1) Color: White.
         2) Configuration: Continuous, fascia extends past continuous bracket.
      b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC
   A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
      1. Material: Thermoplastic olefin (TPO).
      2. Material Certificates and Product Disclosures:
         b. Health Product Declaration (HPD): Complete, published declaration with full disclosure of known hazards.
      3. Performance Requirements:
         a. Flammability: Pass NFPA 701 large and small tests.
         4. Openness Factor: 5%.
         5. Color: As selected by Architect from manufacturer’s full range of colors.
PART 3 EXECUTION

3.01 EXAMINATION
   A. Examine finished openings for deficiencies that may preclude satisfactory installation.
   B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION
   A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
   B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION
   A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
   B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING
   A. Clean soiled shades and exposed components as recommended by manufacturer.
   B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION
   A. Protect installed products from subsequent construction operations.
   B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 23 05 19
METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Pressure gages and pressure gage taps.
B. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS
A. Section 23 21 13 - Hydronic Piping.
B. Section 23 09 23 - Direct-Digital Control System for HVAC.
C. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS
A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
E. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2015.
F. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2012.
G. AWWA C702 - Cold-Water Meters -- Compound Type; 2010.
J. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.
K. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS
A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
B. Project Record Documents: Record actual locations of components and instrumentation.
C. Operation and Maintenance Data: Manufacturer's Standards and Operations and maintenance manuals and catalog cuts.

1.05 FIELD CONDITIONS
A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.06 EXTRA MATERIALS
A. Supply two bottles of red gage oil for static pressure gages.
B. Supply two pressure gages with pulsation damper or dial thermometers.

PART 2 PRODUCTS

2.01 PRESSURE GAGES
A. Manufacturers:
B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 2-1/2 inch (65 mm) diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.02 PRESSURE GAGE TAPPINGS
A. Gage Cock: Tee or lever handle, brass for maximum 150 psi (1034 kPa).
B. Needle Valve: Brass or Stainless Steel, 1/4 inch (6 mm) NPT for minimum 150 psi (1034 kPa).
C. Pulsation Damper: Pressure snubber, brass with 1/4 inch (6 mm) connections.
D. Syphon: Steel, Schedule 40 or Brass, 1/4 inch (6 mm) angle or straight pattern.

2.03 STEM TYPE THERMOMETERS
A. Manufacturers:
B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
   1. Size: 7 inch (175 mm) scale.
   2. Window: Clear glass or Lexan.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.
C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 7 inch (175 mm) scale.
   2. Window: Clear glass or Lexan.
   3. Stem: 3/4 inch (20 mm) NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.04 DIAL THERMOMETERS
A. Manufacturers:
B. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
   1. Size: 2-1/2 inch (60 mm) diameter dial.
   2. Lens: Clear glass or Lexan.
   3. Accuracy: 1 percent.
   4. Calibration: Degrees F.
C. Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
   1. Size: 3 inch (75 mm) diameter dial.
   2. Lens: Clear glass or Lexan.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

D. Thermometers: Dial type vapor or liquid actuated; ASTM E1; stainless steel case, with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens.
1. Size: 2-1/2 inch (60 mm) diameter dial.
2. Lens: Clear glass or Lexan.
3. Length of Capillary: Minimum 5 feet (1500 mm).
4. Accuracy: 2 percent.
5. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS
A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
B. Flange: 3 inch (75 mm) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.06 TEST PLUGS
A. Test Plug: 1/4 inch (6 mm) or 1/2 inch (13 mm) brass or stainless steel fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F (176 degrees C).
B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch (60 mm) diameter pressure gages, one gage adapters with 1/8 inch (3 mm) probes, two 1 inch (25 mm) dial thermometers.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.
C. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.
D. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.
E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch (60 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
F. Install thermometers in air duct systems on flanges.
G. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 23 09 43. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.
H. Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.
I. Coil and conceal excess capillary on remote element instruments.
J. Provide instruments with scale ranges selected according to service with largest appropriate scale.
K. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
L. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
M. Locate test plugs adjacent thermometers and thermometer sockets, adjacent to pressure gages and pressure gage taps, adjacent to control device sockets or where indicated.

3.02 SCHEDULE

A. Pressure Gages, Location:
   1. Pumps.
   2. Expansion tanks.
   3. Pressure tanks.
   4. Standpipe, highest points.
   5. Standpipe and sprinkler water supply connection.
   6. Sprinkler system.
   7. Pressure reducing valves.
   8. Backflow preventers.

B. Pressure Gage Tappings, Location:
   1. Control valves 3/4 inch (20 mm) & larger - inlets and outlets.
   3. Heat exchangers - inlets and outlets.
   5. Boiler - inlets and outlets.

C. Stem Type Thermometers, Location and Scale Range:
   1. Headers to central equipment.
   2. Coil banks - inlets and outlets.
   3. Heat exchangers - inlets and outlets.
   5. Chiller - inlets and outlets.
   6. Water zone supply and return.
   7. After major coils.
   8. Domestic hot water supply and recirculation.

D. Thermometer Sockets, Location:
   1. Control valves 1 inch (25 mm) & larger - inlets and outlets.
   2. Reheat coils - inlets and outlets.
   3. Cabinet heaters - inlets and outlets.
   4. Unit heaters - inlets and outlets.

E. Dial Thermometers, Location and Scale Range:
   1. ERV Outside air.
   2. ERV Return air.
   3. ERV Exhaust air.
   4. ERV Supply air.

F. Static Pressure and Filter Gages, Location and Scale Range:
   1. Built up filter banks.
   2. Unitary filter sections.
   4. Building static.

END OF SECTION
SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Nameplates.
B. Tags.
C. Stencils.
D. Pipe Markers.

1.02 RELATED REQUIREMENTS
A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C. Product Data: Provide manufacturers catalog literature for each product required.
D. Samples: Submit two labels or tags 1/2 x ____ inch (____ x ____ mm) in size.
E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS
2.01 MANUFACTURERS

2.02 NAMEPLATES
A. Description: Laminated three-layer plastic with engraved letters.
   2. Letter Height: 1/2 inch (13 mm).

2.03 TAGS
A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
B. Metal Tags: Aluminum with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS
A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
   2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
   3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.
5. Over 10 inch (250 mm) Outside Diameter of Insulation or Pipe: 32 inch (800 mm) long color field, 3-1/2 inch (90 mm) high letters.
6. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.
B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS
B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

2.06 CEILING TACKS
A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.
B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.

PART 3 EXECUTION

3.01 PREPARATION
A. Degrease and clean surfaces to receive adhesive for identification materials.
B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION
A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
B. Install tags with corrosion resistant chain.
C. Apply stencil painting in accordance with Section 09 90 00.
D. Install plastic pipe markers in accordance with manufacturer's instructions.
E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
F. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
H. Identify control panels and major control components outside panels with plastic nameplates.
I. Identify thermostats relating to terminal boxes or valves with nameplates.
J. Identify valves in main and branch piping with tags.
K. Identify air terminal units and radiator valves with numbered tags.
L. Tag automatic controls, instruments, and relays. Key to control schematic.
M. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers or stencilled painting. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service,
flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

N. Identify ductwork with plastic nameplates or stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

O. Locate ceiling tacks to locate valves, units, or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION
SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Testing, adjustment, and balancing of air systems.
B. Testing, adjustment, and balancing of hydronic systems.
C. Measurement of final operating condition of HVAC systems.
D. Sound measurement of equipment operating conditions.
E. Vibration measurement of equipment operating conditions.
F. Commissioning activities.

1.02 RELATED REQUIREMENTS
A. Section 01 91 10 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
B. Section 01 91 10 - Functional Testing Procedures
C. Section 23 08 00 - Mechanical Systems Commissioning
D. Section 23 08 10 - Control Systems Commissioning

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   5. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
g. Detailed step-by-step procedures for TAB work for each system and issue, including:
   1) Terminal flow calibration (for each terminal type).
   2) Diffuser proportioning.
   3) Branch/submain proportioning.
   4) Total flow calculations.
   5) Rechecking.
   6) Diversity issues.

h. Expected problems and solutions, etc.
i. Criteria for using air flow straighteners or relocating flow stations and sensors.
j. Details of how TOTAL flow will be determined; for example:
   1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
   2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
l. Confirmation of understanding of the outside air ventilation criteria under all conditions.
m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
n. Method of checking building static and exhaust fan and/or relief damper capacity.
o. Proposed selection points for sound measurements and sound measurement methods.
p. Methods for making coil or other system plant capacity measurements, if specified.
q. Time schedule for TAB work to be done in phases (by floor, etc.).
r. Description of TAB work for areas to be built out later, if any.
s. Time schedule for deferred or seasonal TAB work, if specified.
t. False loading of systems to complete TAB work, if specified.
u. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
v. Interstitial cavity differential pressure measurements and calculations, if specified.
w. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
x. Procedures for formal progress reports, including scope and frequency.
y. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least once a week to Commissioning Authority and Construction Manager.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Progress Reports.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor within two weeks after completion of testing, adjusting, and balancing.
   2. Revise TAB plan to reflect actual procedures and submit as part of final report.
   3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. Project Architect.
   g. Project Engineer.
   h. Project Contractor.
   i. Project altitude.
   j. Report date.

G. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.05 QUALITY ASSURANCE (MOVED TO PART 3)
1.06 PRE-BALANCING MEETING (MOVED TO PART 3)
1.07 SEQUENCING AND SCHEDULING (MOVED TO PART 3)
1.08 WARRANTY (MOVED TO PART 3)

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   5. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

F. TAB Supervisor Qualifications: Professional Engineer licensed in the State in which the Project is located.
3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
  10. Air outlets are installed and connected.
  11. Duct system leakage is minimized.
  12. Hydronic systems are flushed, filled, and vented.
  13. Pumps are rotating correctly.
  14. Proper strainer baskets are clean and in place.
  15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE
A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
C. Measure air quantities at air inlets and outlets.
D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
F. Vary total system air quantities by adjustment of fan speeds. Provide drive and sheave changes required. Vary branch air quantities by damper regulation.
G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

3.07 WATER SYSTEM PROCEDURE
A. Adjust water systems to provide required or design quantities.
B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
D. Effect system balance with automatic control valves fully open to heat transfer elements.
E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 SCOPE
A. Test, adjust, and balance the following:
   1. Unit Ventilators

3.09 MINIMUM DATA TO BE REPORTED
A. Electric Motors:
1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. V-Belt Drives:
1. Identification/location
2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Heating Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Water flow, design and actual
7. Water pressure drop, design and actual
8. Entering water temperature, design and actual
9. Leaving water temperature, design and actual
10. Entering air temperature, design and actual
11. Leaving air temperature, design and actual
12. Air pressure drop, design and actual

D. Air Moving Equipment:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

E. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

F. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

END OF SECTION
SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping insulation.
B. Jackets and accessories.

1.02 RELATED REQUIREMENTS
A. Section 07 84 00 - Firestopping.
B. Section 09 90 00 - Painting and Coating: Painting insulation jacket.
C. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.
D. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.
E. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS
A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

1.04 SUBMITTALS
A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS
A. Maintain ambient conditions required by manufacturers of each product.
B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS
2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION
A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER
A. Manufacturers:
B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' ('Ksi') value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   3. Maximum moisture absorption: 0.2 percent by volume.
C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' ('Ksi') value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   3. Maximum moisture absorption: 0.2 percent by volume.
D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).
E. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
F. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

G. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

H. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
   2. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
   3. Weave: 5x5.

I. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

J. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Outdoor Breather Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

L. Insulating Cement:
   1. ASTM C449/C449M.

2.03 CELLULAR GLASS

A. Manufacturers:
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C552, Grade 1.
   1. 'K' (ksi) value: 0.37 at 100 degrees F (0.053 at 38 degrees C).
   2. Service Temperature: Up to 900 degrees F (482 degrees C).
   3. Water Vapor Permeability: 0.005 perm inch (0.007 ng/Pa s m).
   4. Water Absorption: 0.2 percent by volume, maximum.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F (-40 degrees C).

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      b. Substitutions: See Section 01 60 00 - Product Requirements.

   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (-18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil (0.25 mm).
      e. Connections: Brush on welding adhesive.

   3. Covering Adhesive Mastic:
a. Compatible with insulation.

B. ABS Plastic:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      b. Maximum Service Temperature of 180 degrees F (82 degrees C).
      c. Moisture Vapor Permeability: 0.012 perm inch (0.018 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
      d. Thickness: 30 mil (0.76 mm).
      e. Connections: Brush on welding adhesive.

C. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   1. Lagging Adhesive:
      a. Compatible with insulation.

   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.
   6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that piping has been tested before applying insulation materials.
   B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install in accordance with NAIMA National Insulation Standards.
   C. Exposed Piping: Locate insulation and cover seams in least visible locations.
   D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   E. Glass fiber insulated pipes conveying fluids below ambient temperature:
      1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
      2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
   F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
   G. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.
   H. Glass fiber insulated pipes conveying fluids above ambient temperature:
      1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
      2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   I. Inserts and Shields:
1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

A. PIPING INSULATION SCHEDULES
1. General: Abbreviations used in the following schedules include:

B. INTERIOR PIPING APPLICATION SCHEDULE
1. Service: Heating hot-water supply and return.
   a. Operating Temperature: 100 to 250 deg F.
   b. Insulation Material: Mineral fiber or glass fiber.
   c. Insulation Thickness: Apply the following insulation thicknesses:
      1) Pipe, 1” or less: 1.0 inch.
      2) Pipe, 1-1/4” to 4”: 1.5 inch.
      3) Pipe, 5” and up: 2.0 inch.
   d. Jacket: PVC.
   e. Vapor Retarder Required: No.
   f. Finish: None.

C. BURIED PIPING INSULATION SCHEDULE
1. Pre-insulated piping system as specified in section 23 21 13.

END OF SECTION
SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Input/Output Sensors:
B. Thermostats, Temperature Sensors.
C. Control valves.
D. Automatic dampers.
E. Damper operators.
F. Miscellaneous accessories.

1.02 RELATED REQUIREMENTS
A. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gage taps.
B. Section 23 33 00 - Air Duct Accessories: Installation of automatic dampers.
C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.
D. Section 23 09 23 - Direct-Digital Control System for HVAC.
E. Section 23 09 93 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
D. Manufacturer's Instructions: Provide for all manufactured components.
E. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
F. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL VALVES

A. Pressure Independent Balancing and Control Valves:

1. Application: Fan Coils, radiant units, chilled beams, and other terminal units.

2. Pressure independent balancing and control valves shall combine the functions of control, balancing, presetting, measuring, shut-off and differential pressure control in one valve body to maintain full controllability at any opening positions of the control part regardless of any pressure variations in other parts of the systems through the lifecycle of heating and cooling systems.

3. Manufacturers

a. IMI-TA/Tour & Andersson/TA Hydronics Model COMPACT-P or approved equal by Owner and Engineer. Application for approval required at least 10 days prior to bid opening.

4. Design

a. The valve shall have an in-built linear control valve characteristic, best suited for on-off control.

b. The valve shall have flow balancing, isolation, a two-way control valve and differential pressure regulator in the same body.

c. The valve shall have an integrated differential pressure controller to maintain full controllability at any opening of the control part regardless of pressure changes in the system up to the max Dp rating of the valve (58 psi).

d. The valve isolation for system maintenance should be achieved by the control actuator or through the in-built dial position.

e. The valve internals shall have a plug and seat for balancing and controlling flow from the regulated position.

f. The valve should be able to have an in-built manual adjustment to preset maximum flow values in the field in a conventional manner. The adjustment mechanism should be covered with the actuator during the operation to prevent tampering.

g. The valve shall have a capability of bypassing DP controller to enable measurement of available head.

h. The valve shall have a capability to measure the flow, temperature, pressure drop and available head directly through the standard pressure and temperature ports available on the front side of the valve body.

i. The pressure independent balancing and control valve for small terminal units shall have a startup pressure of no more than 2.2 psi (1/2” and 3/4”) and no more than 3.7 psi (1” and 1 ¼”).

j. The pressure independent balancing and control valve for small terminal units shall require no maintenance and shall not include replaceable cartridges.

k. The valves shall be available with a Normally Open or Normally Closed on-off actuator (IMI-TA Model. EMO-T) having a M30 X 1.5 threads on the actuator-locking nut. (Normally closed modulating actuator (IMI-TA Model. EMO-TM) may be installed directly on the valve via the M30 X 1.5 threads if desired.)

l. The valve shall have availability of different connections like female NPT and female SWT connections available via a union connection nut.

5. Size:
a. Pressure Independent Balancing and Control valve shall be available in following sizes and connections:
   1) Valve size ½" - Connections ½" FPT/SWT
   2) Valve size ¾" - Connections ½" FPT/SWT, ¾" FPT/SWT
   3) Valve size 1" - Connections ½" FPT/SWT, ¾" FPT/SWT, 1" FPT/SWT
   4) Valve size 1 ¼" - Connections 1" FPT/SWT, 1 ¼" FPT/SWT

6. Material and Construction
   a. The valve body and the self-sealing pressure test points shall be made of a dezincification resistant alloy
   b. The insert and plug shall consists of Stainless Steel and/or Ametal® material
   c. The return spring shall be stainless steel
   d. The valve insert shall be dezincification resistant alloy (Ametal®) and PPS (polyphenylsulphide)
   e. The valve spindle shall be of Stainless Steel
   f. The valve shall be fitted with two standard PT test points.

7. Testing and Ratings
   a. Tests- Valves shall be leak proof and tested at 85 psi of air.
   b. Ratings
   c. The valves shall be rated for a pressure class of PN 16 (230 psi) at 32°F to 176 °F

8. Installation
   a. Install in accordance with manufacturer’s instructions.

9. Measuring and Verification
   a. Flow shall be measured at each combined control and balancing valve for small terminal units, through the available P/T ports on the body and the use of IMI-TA balancing instrument Model TA-SCOPE by having the actuator fully open.

10. Packaging
    a. The valves and actuators shall be shipped in individual boxes combined in a single package box.
    b. The end connections will be ordered separately and shipped in their own packing.

B. Globe Pattern Type:
   1. Application: Air handlers, equipment shut-off and isolation.
   2. Up to 2 inches (50 mm): Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
      a. Product:
         1) Substitutions: See Section 01 60 00 - Product Requirements.
   3. Over 2 inches (50 mm): Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
      a. Product:
         1) Substitutions: See Section 01 60 00 - Product Requirements.
   4. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F (860 kPa at 121 degrees C).
      b. Replaceable plugs and seats of stainless steel.
      c. Size for 3 psig (20 kPa) maximum pressure drop at design flow rate.
      d. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.
   5. Steam Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F (860 kPa at 121 degrees C).
      b. Replaceable plugs and seats of stainless steel. Pressure drop across any steam valve at maximum flow shall be as shown on the Drawings.
      c. Size for 10 psig (70 kPa) inlet pressure and 5 psig (35 kPa) pressure drop.
      d. Valves shall have modified linear characteristics.

C. Butterfly Pattern:
   1. Application: Air handlers, equipment shutoff, mixing and diverting.
2. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F (82 degrees C) wafer or lug ends, extended neck.

3. Hydronic Systems:
   a. Rate for service pressure of 125 psig at 250 degrees F (860 kPa at 121 degrees C).
   b. Size for 1 psig (7 kPa) maximum pressure drop at design flow rate.

D. Electronic Actuators:
   1. 24 V powered, 4-20 mA proportional signal electronic actuator for valves and dampers.
   2. Actuators shall spring return to normal open position as indicated on freeze, fire, or temperature protection.
   3. Select operator for full shut off at maximum pump differential pressure.

2.03 DAMPERS
A. Performance: Test in accordance with AMCA 500-D.
B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage (2.7 mm).
C. Blades: Galvanized steel, maximum blade size 8 inches (200 mm) wide, 48 inches (1200 mm) long, minimum 22 gage (0.85 mm), attached to minimum 1/2 inch (13 mm) shafts with set screws.
D. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.
E. Jamb Seals: Spring stainless steel.
F. Shaft Bearings: Oil impregnated sintered bronze.
G. Linkage Bearings: Oil impregnated sintered bronze.
H. Leakage: Less than one percent based on approach velocity of 2000 ft/min (10 m/sec) and 4 inches wg (1.0 kPa).
I. Maximum Pressure Differential: 6 inches wg (1.5 kPa).
J. Temperature Limits: -40 to 200 degrees F (-40 to 93 degrees C).

2.04 DAMPER OPERATORS
A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft (3.24 sq m) damper section.
B. Electric Operators:
   1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.05 INPUT/OUTPUT SENSORS
A. Temperature Sensors:
   1. Sensor range shall provide a resolution of no worse than .4°F (unless noted otherwise).
   2. Room temperature sensor shall be an element contained within a ventilated cover, suitable for wall mounting with digital output. Sensors located in mechanical areas, plenums, garages, gymnasiums, or designated institutional locations shall be a flat plate sensor with no possible adjustment or shall be provided with aesthetically-pleasing lockable protective cover. Security screws shall be used in institutional settings as deemed necessary by the design engineer. ATC contractor shall coordinate requirements with the design engineer during the submittal process. Provide insulated base. Following sensing elements are acceptable:
      a. Sensing element - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.
      b. Units shall be capable of +/- 2 degrees (F) adjustment by the occupant, with display showing current temperature and setpoint.
3. Single point duct temperature sensor shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Temperature range as required for resolution indicated in paragraph A. Sensor probe shall be 316 stainless steel.
   a. Sensing element - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.

4. Averaging duct temperature sensor shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide enough sensors to give one lineal foot of sensing element for each square foot of cooling coil face area. Temperature range as required for resolution indicated in paragraph A.
   a. Sensing element - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.

5. Liquid immersion temperature sensor shall include stainless steel thermowell, sensor and connection head for wiring connections.
   a. Sensing element for chilled water applications - Platinum RTD, Thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point. Temperature range shall be as required for resolution indicated in paragraph A.
   b. Sensing element for non-chilled water applications - Platinum RTD, +/- 0.2°F accuracy at calibration point. Temperature range shall be as required for resolution of no worse than 0.1°F.

B. Equipment Operation Sensors:
   1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg (0 to 1250 Pa).
   2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi (50 to 400 kPa).

C. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

D. Carbon Dioxide Level Sensors:
   1. Wall or duct-mounted as required by control sequence or plans.
   2. Demand-control ventilation sensor for measuring and transmitting CO2 levels ranging from 0-2,000 ppm.
   4. Proportional output, 4-20 mA signal.

2.06 THERMOSTATS

A. Line Voltage Thermostats:
   1. Integral manual On/Off/Auto selector switch, single or two pole as required.
   2. Dead band: Maximum 2 degrees F (one degree C).
   3. Cover: Locking with set point adjustment, with thermometer.

B. Outdoor Reset Thermostat:
   1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
   2. Scale range: -10 to 70 degrees F (2 to 35 degrees C).

C. Immersion Thermostat:
   1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.

D. Airstream Thermostats:
   1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
   2. Averaging service remote bulb element: 7.5 feet (2.3 m).
E. Electric Low Limit Duct Thermostat:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below setpoint,
   2. Bulb length: Minimum 20 feet (6 m).
   3. Provide one thermostat for every 20 sq ft (1.86 sq m) of coil surface.
F. Electric High Limit Duct Thermostat:
   1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above setpoint,
   2. Bulb length: Minimum 20 feet (6 m).
   3. Provide one thermostat for every 20 sq ft (1.86 sq m) of coil surface.
G. Fire Thermostats:
   1. UL labeled, factory set in accordance with NFPA 90A.
H. Heating/Cooling Valve Top Thermostats:
   1. Proportional acting for proportional flow, molded rubber diaphragm, remote bulb liquid filled element, direct and reverse acting at differential pressure to 25 psig (172 kPa), cast housing with position indicator and adjusting knob.

2.07 TRANSMITTERS
A. Pressure Transmitters:
   1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.
B. Temperature Transmitters:
   1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degree F (93 degrees C) span and plus or minus 1 percent for 50 degree F (10 degrees C) span, with 50 degrees F (10 degrees C) temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig (138 kPa) input pressure and 3 to 15 psig (20 to 100 kPa) output.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that systems are ready to receive work.
C. Beginning of installation means installer accepts existing conditions.
D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
F. Ensure installation of components is complementary to installation of similar components.
G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches (1200 mm) above floor. Align with lighting switches, CO2 sensors, and humidistats. Refer to Section 26 2726.
C. Mount freeze protection thermostats using flanges and element holders.
D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
E. Provide separable sockets for liquids and flanges for air bulb elements.
F. Provide thermostats in aspirating boxes in front entrances.
G. Provide guards on thermostats in entrances.
H. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
I. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide separate minimum outside air damper section adjacent to return air dampers with separate damper motor.
J. Provide isolation (two position) dampers of parallel blade construction.
K. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
L. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
M. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
N. Provide conduit and electrical wiring in accordance with Section 26 27 17. Electrical material and installation shall be in accordance with appropriate requirements of .
O. Install pressure independent balancing and control valves for small terminal units on the supply or return lines of coils.
   1. For accuracy in flow measurements try to avoid mounting taps and pumps immediately before or after the valve. A minimum distance of five times the pipe diameter and ten times the pipe diameter before the valve for taps and pump respectively is recommended before the valve. A minimum distance of two times the pipe diameter is recommended after the valve.
   2. The actuator for the combined manual balancing and control valves for small terminal units can be installed in any position as per manufacturer’s recommendations.
   3. Install in accordance with manufacturer’s instructions.

3.03 MAINTENANCE
A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
B. Provide service and maintenance of control system for one year from Date of Substantial Completion.

END OF SECTION
SECTION 23 09 58
SEQUENCE OF OPERATION

PART 1 - GENERAL
1.01 SECTION INCLUDES
   A. Heat Transfer Terminal Units (Unit Ventilators and Fan Coils)

1.02 RELATED DOCUMENTS:
   A. Section 23 09 13 - Instrumentation and Control Devices for HVAC

1.03 SYSTEM DESCRIPTION
   A. The systems to be controlled under work of this section basically comprise the replacement of unit ventilators. The systems being controlled are hydronic, heating only unit ventilators.
   B. This Section defines the manner and method by which controls function.

1.04 SUBMITTALS
   A. Refer to Section 23 09 50 and Division 1 for requirements for control shop drawings, product data, User Manual, etc.
   B. Programming Manual: Provide BAS system programming manual as well as documentation of site-specific programming prior to the start of Acceptance Phase.

1.05 PROJECT RECORD DOCUMENTS
   A. Record documents shall be modified control drawings with the actual installed information. Drawings shall be delivered in both reproducible hard copy and electronic format in AutoCAD (current version) drawing files. Provide all supporting files, blocks, fonts, etc. required by the drawings.
   B. Provide final points list as described above.
   C. Provide final detailed wiring diagrams with all wire numbers and termination points indicated.
   D. Accurately record final sequences and control logic made after submission of shop drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION
3.01 GENERAL
   A. Sequences specified herein indicate the functional intent of the systems operation and may not fully detail every aspect of the programming that may be required to obtain the indicated operation. Contractor shall provide all programming necessary to obtain the sequences/system operation indicated.
   B. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials shall be centered on the associated setpoint. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Unless the loop is specified "proportional only" or "P+I", Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.
   C. Scheduling Terminology: When air handlers are scheduled throughout the day, the following defines the terminology used (Designer coordinate with The State regarding actual occupancy schedules and initial setpoints):
      1. OCCUPIED PERIOD: PERIOD OF TIME WHEN THE BUILDING IS IN USE AND OCCUPIED. UNLESS INDICATED OTHERWISE, THIS PERIOD IS DEFINED AS 7:30 AM - 5:00 PM, USER ADJUSTABLE, WEEKDAYS AND 7:30 AM TO 12:00PM (NOON) SATURDAYS. EXCLUDE ALL NATIONAL HOLIDAYS. GENERALLY SYSTEMS WILL BE FULLY OPERATIONAL THROUGHOUT THIS PERIOD AND VENTILATION AIR SHALL BE CONTINUOUSLY INTRODUCED. SPACE TEMPERATURE SETPOINTS WILL GENERALLY BE IN THE "NORMAL" RANGE OF 69-77°F.
2. Unoccupied period: Period of time when the building or zone is not in use and unoccupied. Ventilation air shall not be introduced.

3. Preoccupancy Period: Time prior to the Occupied period when the systems are returning the space temperatures from setback to "normal" or occupied setpoints (warm-up and cool-down). Ventilation air shall not be introduced unless outside air conditions permit free-cooling. Time period shall be determined by an optimum start strategy unless otherwise specified.

4. Setback Period: Setback will typically coincide start with the end of the occupied period and end with the start of the preoccupancy period, however it shall be provided with its own schedule. Generally systems will be off except to maintain a “setback” temperature.
   a. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the BAS start commands shall be staggered by 5 second (adj.) intervals to minimize inrush current.

D. Alarm messages specified throughout the sequences are assigned to discrete priority levels. Priority levels dictate the handling and destination of alarm reports, and are defined in Section 23 09 55 - ATC System Software and Programming.

E. Wherever a value is indicated as adjustable (adj.), it shall be modifiable, with the proper privilege level, from the operator interface or via a function block menu. For these points, it is unacceptable to have to modify programming statements to change the setpoint.

F. Where reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, one of the following methods shall be employed:
   1. Contractor shall determine a fixed reset schedule which shall result in stable operation and shall maintain the primary variable within the specified maximum allowable variance.
   2. A floating reset algorithm shall be used which increments the secondary variable setpoint (setpoint of control loop being reset) on a periodic basis to maintain primary variable setpoint. The recalculation time and reset increment shall be chosen to maintain the primary variable within the specified maximum allowable variance.
   3. Primary variable shall control the devices directly using a PID feedback control loop without resetting the secondary variable. However, the control devices shall still modulate as necessary to maintain upper and lower limits on the secondary variable. Proportional band, integral gain, and derivative term shall be selected to maintain the primary variable within the specified maximum allowable tolerance while minimizing overshoot and settling time. Contractor shall gain prior approval for implementing this method of reset.

G. Where a supply air temperature or duct pressure setpoint is specified to be reset by the space temperature of the zones calling for the most cooling/heating, the following method shall be employed:
   1. A floating reset algorithm shall be used which increments the secondary variable (e.g., supply air temperature or duct pressure) setpoint on a periodic basis to maintain primary variable (e.g. space temperature) setpoint. The reset increment shall be determined by the quantity of “need heat” or “need cool” requests from individual SCU's. A SCU’s “need heat” virtual point shall activate whenever the zone's space temperature falls below the currently applicable (occupied or unoccupied) heating setpoint throttling range. A SCU's "need cool" virtual point shall activate whenever the zone's space temperature rises above the currently applicable (occupied, unoccupied, or economy) cooling setpoint throttling range. The recalculation time and reset increment shall be chosen to maintain the primary variable within the specified maximum allowable variance while minimizing overshoot and settling time. Reset range maximum and minimum values shall limit the setpoint range.

H. Where “prove operation” of a device (generally controlled by a digital output) is indicated in the sequence, it shall require that the BAS shall, after an adjustable time delay after the device is commanded to operate (feedback delay), confirm that the device is operational via the status input. If the status point does not confirm operation after the time delay or anytime thereafter for an adjustable time delay (debounce delay) while the device is commanded to run, an alarm shall be enunciated audibly and via an alarm message at the operator interface and print at the alarm printers. A descriptive message shall be attached to the alarm message indicating the
nature of the alarm and actions to be taken. Contractor shall provide messages to meet this intent. Upon failure of equipment with redundant backup, run command shall be removed from equipment and the device shall be locked out until the alarm is manually acknowledged. Upon failure of equipment without redundant backup, run command shall remain energized and the alarm shall be latched until reset by an operator. BAS shall provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points:

1. Speed control of variable speed drives

I. Wherever a value is indicated to be dependent on another value (i.e.: setpoint plus 5°F) BAS shall use that equation to determine the value. Simply providing a virtual point that the operator must set is unacceptable. In this case three virtual points shall be provided. One to store the parameter (5°F), one to store the setpoint, and one to store the value which is the result of the equation.

3.02 UNIT VENTILATORS AND FAN COILS

A. Each unit shall be controlled by an individual DDC Controller. The DDC Controller shall be wired to a space temperature sensor, space-level CO2 sensor, discharge air temperature sensor, return air temperature sensor, and modulating OA damper operator.

B. Heating Mode:
   1. During the programmed occupied mode, the supply fan shall run continuously with the outside air damper open to the scheduled position and the relief damper shall open. On a drop in temperature above the programmed heating setpoint (adjustable), the following shall occur, in order, and to the extent necessary:
      a. During the occupied period, the OA damper shall never be positioned less than the minimum position. Minimum position shall be reset between the design minimum position delivering design minimum CFM to maintain a CO2 setpoint of 800 ppm (adj.) or maintain a specified delta between outside air CO2 and indoor CO2. Loop shall be a “sample and bump” or dynamic proportional only loop tuned for the slow response. The balancer shall determine the minimum position outputs at both extreme points.
      b. The hot water control valve shall modulate open to provide the maximum discharge air value allowed (95 degrees F, adj.). A minimum discharge air temperature setting shall also be enabled to prevent supply air from dropping below 55 degrees (adj.).
      c. Upon a rise in space temperature the reverse shall occur.
      d. Provide a freezestat for coil protection capable of automatic reset or manual reset from operator's terminal. Upon activation, the outdoor air dampers shall close, the fan shall be deenergized, and the heating control valve shall fail open to 100%.

C. Unoccupied Mode:
   1. During the programmed un-occupied mode, the supply fan and control valve shall be cycled / modulated to maintain the un-occupied setpoint (55 degrees, adj.)

D. All setpoints and shall be adjustable at the BAS workstation.

E. Provide a current sensor on one phase of power feeding each supply fan for status indication at the Operator's Terminal.

F. If the discharge temperature fails to rise to a programmed minimum temperature during a call for heating; a low temperature alarm shall be activated at the Operator's Terminal. If the discharge temperature fails to fall to a programmed minimum temperature on a call for mechanical cooling, a high temperature alarm shall be activated at the Operator's Terminal.

G. The following items shall be displayed at the Operator's Terminal:
   1. Space temperature.
   2. Space temperature setpoint.
   3. Space humidity.
   4. Space humidity setpoint.
   5. Low Space temperature alarm.
   6. High Space temperature alarm.
   7. Discharge air temperature.
8. Discharge air temperature setpoint.
9. Return air temperature.
10. Outside air temperature, humidity and enthalpy.
11. Economizer enthalpy setpoint.
12. Space CO2 level.
13. Space CO2 level setpoint.
15. Supply fan operational status via current sensor.
17. Commanded status of compressor(s).
18. Commanded status of hot water control valve.
19. Freezestat status.
21. Diagram showing the layout of the unit with major components and dynamic temperatures shown where temperature sensors exist in the system.

3.03 HYDRONIC FIN TUBE RADIATION AND CONVECTORS

A. The hydronic fin tube radiation loop shall be controlled by individual fully-modulating DDC-controlled control valves and shall be interlocked to the operation of the air handling units within the space.
B. When the system is in cooling mode the control valve shall remain closed.
C. When the outdoor air temperature is above 30 deg. F (adj.), the control valve shall remain closed.
D. The valve shall modulate in conjunction with the control valve on the hot water coil of the paired AHU within the space. The valve shall modulate toward the open position upon a decrease in space temperature below setpoint and the reverse shall occur upon an increase in space temperature above setpoint.
E. Provide an alarm if the space falls to a temperature of greater than 5 degrees under setpoint.
F. The following items shall be displayed at the Operator's Terminal:
   1. Temperature Setpoint.
   2. Actual space temperature.
   3. Commanded position of control valve.
   4. Alarms.

3.04 UNIT HEATERS AND CABINET UNIT HEATERS

A. Provide a room temperature sensor and associated controller to provide control of each unit. Setpoint at ____ degrees F (68 degrees C) (adjustable), maintain constant space temperature by cycling unit fan motor adjusting control valve to the heating coil.
B. Provide an alarm if the space falls to a temperature of greater than 5 degrees under setpoint.
C. When the system is in cooling mode the control valve shall remain closed.
D. The following items shall be displayed at the Operator's Terminal:
   1. Temperature Setpoint.
   2. Actual space temperature.
   3. Commanded position of control valve.
   4. Alarms

3.05 EXHAUST FANS

A. Exhaust Fans Serving Electrical Rooms or IT / Telephone Rooms
   1. Exhaust fans serving electrical rooms shall be controlled by a line-voltage thermostat set to engage the fan when the temperature exceeds 85 degrees in the space (adjustable).
   2. Where indicated on the drawings and schedules, provide a motor operated damper on the fan and associated supply-air louver. Dampers to open when fan is engaged.
   3. Electrical Room Exhaust Fan Monitoring
a. Provide a current sensor indicating operational status of the fan on the monitoring screen at the BAS terminal.
b. Provide a status indicator for each MOD position on the monitoring screen at the BAS terminal via end switch.
c. Provide temperature reading in each room on the monitoring screen at the BAS terminal.
d. Provide an alarm on the monitoring screen if the temperature exceeds 100 degrees (user adjustable).

B. Exhaust Fans Serving Toilet Rooms
1. Exhaust fans serving toilet rooms shall operate on occupancy schedule. The fans shall automatically engage at the scheduled start time (user adj.) and shall automatically dis-engage at the scheduled end time (user adj.).
2. Where indicated on the drawings and schedules, provide a motor operated damper on the fan. Dampers to open when the fan is engaged.
3. Toilet Room Exhaust Fan Monitoring
   a. Provide a current sensor indicating operational status of the fan on the monitoring screen at the BAS terminal.
   b. Provide a status indicator for each MOD position on the monitoring screen at the BAS terminal via end switch.

3.06 HOT WATER SYSTEM
A. See drawings for central plant sequence of operations.
B. Heating Water System Monitoring
   1. The following points shall be monitored and displayed at the operator's terminal:
      a. Building Loop Supply Temperature
      b. Building Loop Return Temperature
      c. Boiler Loop Supply Temperature
      d. Boiler Loop Return Temperature
      e. Boiler temperature setpoint (including all resets)
      f. Boiler Status Contacts
      g. Boiler Alarm Contacts
      h. Boiler low water cut off
      i. Building Loop Circulator and recirculator pump(s) status via current switch
      j. Building Loop pump flow status via differential pressure switch
      k. Building Loop differential pressure setpoint
      l. Building loop differential pressure reading
      m. Lead / lag status of each boiler and pump
      n. Diagram showing the layout of the boiler room, boiler loop, and building loop with major components and dynamic temperatures and pressures shown where all temperature sensors exist in the system

3.07 CHILLED WATER SYSTEM
A. See drawings for central plant sequence of operations.
B. Chilled Water System Monitoring - The following points shall be monitored and displayed at the operator's terminal:
   1. Chiller Status
   2. Pump Status
   3. Isolation (Control) Valve Status
   4. High and Low Chilled Temperature Alarms
   5. Primary (Chiller) Loop Supply Temperature
   6. Primary (Chiller) Loop Return Temperature
   7. Secondary (Building) Loop Supply Temperature
   8. Secondary (Building) Loop Return Temperature
   9. Primary and secondary pumping flow status via current sensors
10. Secondary pump differential pressure reading
11. Secondary pump differential pressure setpoint
12. Air cooled chiller status, errors, and alarm status as provided by factory BAS interface
13. Diagram showing the layout of the central plant, chilled water loop, and building loop with major components and dynamic temperatures and pressures shown where temperature sensors exist in the system.

END OF SECTION
SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Hydronic system requirements (Chilled water, hot water, dual temperature)
B. Heating water piping, above grade.
C. Pipe hangers and supports.
D. Unions, flanges, mechanical couplings, and dielectric connections.
E. Valves:
   1. Gate valves.
   2. Globe or angle valves.
   3. Ball valves.
   4. Plug valves.
   5. Butterfly valves.
   6. Check valves.
F. Flow controls.

1.02 RELATED REQUIREMENTS
A. Section 07 84 00 - Firestopping.
B. Section 08 31 00 - Access Doors and Panels.
C. Section 09 90 00 - Painting and Coating.
D. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.
E. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
F. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
G. Section 22 07 19 - Plumbing Piping Insulation.
H. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
I. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
J. Section 23 05 48 - Vibration and Seismic Controls for HVAC.
K. Section 23 05 53 - Identification for HVAC Piping and Equipment.
L. Section 23 07 19 - HVAC Piping Insulation.
M. Section 23 21 14 - Hydronic Specialties.
N. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.
O. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS
C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
F. ASME B31.9 - Building Services Piping; 2014.
G. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
H. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2006.
I. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).
N. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
Z. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
AA. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.
AC. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.
AE. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2005 (ANSI/AWWA C105/A21.5).
1.04 ADMINISTRATIVE REQUIREMENTS

1.05 SYSTEM DESCRIPTION
A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
B. Use grooved mechanical couplings and fasteners in accessible locations.
C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
D. Use non-conducting dielectric connections whenever jointing dissimilar metals.
E. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.
F. Use gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
G. Use globe or ball valves for throttling, bypass, or manual flow control services.
H. Use spring loaded check valves on discharge of condenser water pumps.
I. Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
J. Use only butterfly valves in chilled and condenser water systems for throttling and isolation service.
K. Use lug end butterfly valves to isolate equipment.
L. Use 3/4 inch (20 mm) gate or ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.
M. GROOVED MECHANICAL COUPLINGS MAY NOT BE USED ON THIS PROJECT.

1.06 SUBMITTALS
A. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
D. Project Record Documents: Record actual locations of valves.
E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.
C. Welder Qualifications: Certify in accordance with ASME (BPV IX).

1.08 REGULATORY REQUIREMENTS
A. Conform to ASME B31.9 code for installation of piping system.
B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.
C. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.09 DELIVERY, STORAGE, AND HANDLING
   A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
   B. Provide temporary protective coating on cast iron and steel valves.
   C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
   D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.10 FIELD CONDITIONS
   A. Do not install underground piping when bedding is wet or frozen.

1.11 EXTRA MATERIALS
   A. Provide two repacking kits for each size and valve type.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS
   A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
   B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
      1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
      2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
      3. Grooved mechanical joints are not permitted in any location.
      4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
      5. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.
   C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
   D. Valves: Provide valves where indicated:
      1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap.
      2. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
   E. Welding Materials and Procedures: Conform to ASME (BPV IX).

2.02 HEATING WATER PIPING, ABOVE GRADE
   A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
      4. Joints: Threaded or AWS D1.1 welded.
   B. Steel Pipe Sizes 12 Inch (300 mm) and Over: ASTM A53/A53M, 0.375 inch (10 mm) wall, black; using one of the following joint types:
      2. Joints: Welded in accordance with AWS D1.1.
   C. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), hard drawn; using one of the following joint types:
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   b. Brazel: AWS A5.8M/A5.8 BCuP copper/silver alloy.
3. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.

2.03 PIPE HANGERS AND SUPPORTS
A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
B. Conform to ASME B31.9.
C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
D. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
E. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
F. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
G. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
I. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
J. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
K. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
L. Vertical Support: Steel riser clamp.
M. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
N. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
O. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
P. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
Q. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
R. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
S. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.04 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS
A. Unions for Pipe 2 Inches (50 mm) and Under:
   1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.
B. Flanges for Pipe Over 2 Inches (50 mm):
   1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch (1.6 mm) thick preformed neoprene.

C. Dielectric Connections: Union or waterway fitting with water impervious isolation barrier and one galvanized or plated steel end and one copper tube end, end types to match pipe joint types used.

2.05 GATE VALVES

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze trim, screwed or union bonnet, non-rising stem, lockshield stem or handwheel, inside screw with backseating stem, solid wedge disc, alloy seat rings, solder ends.

C. Over 2 Inches (50 mm):
   1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged or grooved ends.

2.06 GLOBE OR ANGLE VALVES

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze trim, screwed or union bonnet, rising stem and handwheel, inside screw with backseating stem, renewable composition disc and bronze seat, solder ends.

C. Over 2 Inches (50 mm):
   1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.07 BALL VALVES

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches (50 mm):
   1. Ductile iron body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, grooved ends or flanged, rated to 800 psi (5515 kPa).
   2. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

2.08 PLUG VALVES

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze tapered plug, full port opening, non-lubricated, teflon packing, threaded ends.
   2. Operator: One plug valve wrench for every ten plug valves minimum of one.

C. Over 2 Inches (50 mm):
   1. Cast iron body and plug, full port opening, pressure lubricated, teflon packing, flanged ends.
   2. Operator: Each plug valve with a wrench with set screw.

2.09 BUTTERFLY VALVES
A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Body:
   Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, grooved, or ________ ends, extended neck.
C. Disc:
   Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, Buna-N encapsulation, or ________________.
D. Body:
   Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
E. Disc:
   Aluminum bronze.
F. Operator:
   10 position lever handle.

2.10 SWING CHECK VALVES
A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
C. Over 2 Inches (50 mm):
   1. Iron body, bronze or_________ trim, stainless steel, bronze, bronze faced rotating, or ____________ swing disc, renewable disc and seat, flanged, grooved, or ___________ ends.
   2. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.11 SPRING LOADED CHECK VALVES
A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.12 FLOW CONTROLS
A. Manufacturers:
   1. Bell & Gossett, a brand of Xylem, Inc; _______: www.bellgossett.com/#sle.
   2. Griswold Controls:
   3. Taco, Inc:
PART 3  EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare piping connections to equipment using jointing system specified.
D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer’s instructions.
B. Install heating water, chilled water, dual-temperature, and condenser water piping to ASME B31.9 requirements.
C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
D. Install piping to conserve building space and to avoid interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Sleeve pipe passing through partitions, walls and floors.
G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
H. Slope piping and arrange to drain at low points.
I. For buried piping, trenches shall be backfilled and hand tamped in 6" layers until a cover of at least 24" from the top of the pipe has been achieved. The first 12" of backfill shall be sand or fine gravel of less than 1/2" diameter. The remainder of the backfill shall be void of rocks, frozen earth, and foreign material of over 4" in diameter. The trench shall be compacted to comply with H-20 highway loading.
J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.
K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
   1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
L. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
M. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

N. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

O. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.

P. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.

Q. Use eccentric reducers to maintain top of pipe level.

R. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

S. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 90 00.

T. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1 inch (25 mm): Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).
   3. 1-1/2 inch (40 mm) and 2 inch (50 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2-1/2 inch (65 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   5. 3 inch (80 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
   6. 4 inch (100 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 1/2 inch (13 mm).
   7. 6 inch (150 mm): Maximum span, 14 feet (4.2 m); minimum rod size, 1/2 inch (13 mm).
   8. 8 inch (200 mm): Maximum span, 16 feet (4.8 m); minimum rod size, 5/8 inch (16 mm).
   9. 10 inch (250 mm): Maximum span, 18 feet (5.5 m); minimum rod size, 7/8 inch (22 mm).
  10. 12 inch (300 mm): Maximum span, 19 feet (5.8 m); minimum rod size, 7/8 inch (22 mm).

B. Hanger Spacing for Steel Piping.
   1. 1/2 inch (15 mm), 3/4 inch (20 mm), and 1 inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1-1/4 inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   3. 1-1/2 inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2 inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
   5. 2-1/2 inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9 mm).
   6. 3 inches (80 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 3/8 inch (9 mm).
7. 4 inches (100 mm): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
8. 6 inches (150 mm): Maximum span, 17 feet (5.1 m); minimum rod size, 1/2 inch (13 mm).
9. 8 inches (200 mm): Maximum span, 19 feet (5.8 m); minimum rod size, 5/8 inch (16 mm).
10. 10 inches (250 mm): Maximum span, 20 feet (6.1 m); minimum rod size, 3/4 inch (19 mm).
11. 12 inches (300 mm): Maximum span, 23 feet (7.0 m); minimum rod size, 7/8 inch (22 mm).
12. 14 inches (350 mm): Maximum span, 25 feet (7.6 m); minimum rod size, 1 inch (25 mm).
13. 16 inches (400 mm): Maximum span, 27 feet (8.2 m); minimum rod size, 1 inch (25 mm).
14. 18 inches (450 mm): Maximum span, 28 feet (8.5 m); minimum rod size, 1-1/4 inch (38 mm).
15. 20 inches (500 mm): Maximum span, 30 feet (9.1 m); minimum rod size, 1-1/4 inch (38 mm).

C. Hanger Spacing for Plastic Piping.
1. 1/2 inch (15 mm): Maximum span, 42 inches (1000 mm); minimum rod size, 1/4 inch (6 mm).
2. 3/4 inch (20 mm): Maximum span, 45 inches (1100 mm); minimum rod size, 1/4 inch (6 mm).
3. 1 inch (25 mm): Maximum span, 51 inches (1300 mm); minimum rod size, 1/4 inch (6 mm).
4. 1-1/4 inches (32 mm): Maximum span, 57 inches (1400 mm); minimum rod size, 3/8 inch (9 mm).
5. 1-1/2 inches (40 mm): Maximum span, 63 inches (1600 mm); minimum rod size, 3/8 inch (9 mm).
6. 2 inches (50 mm): Maximum span, 69 inches (1700 mm); minimum rod size, 3/8 inch (9 mm).
7. 3 inches (80 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 3/8 inch (9 mm).
8. 4 inches (100 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 1/2 inch (13 mm).
9. 6 inches (150 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 1/2 inch (13 mm).
10. 8 inches (200 mm): Maximum span, 11 feet (3.3 m); minimum rod size, 5/8 inch (16 mm).
11. 10 inches (250 mm): Maximum span, 13 feet (3.9 m); minimum rod size, 3/4 inch (19 mm).
12. 12 inches (300 mm): Maximum span, 14 feet (4.2 m); minimum rod size, 7/8 inch (22 mm).
13. 14 inches (350 mm): Maximum span, 15 feet (4.5 m); minimum rod size, 1 inch (25 mm).
14. 16 inches (400 mm): Maximum span, 16 feet (4.8 m); minimum rod size, 1 inch (25 mm).
15. 18 inches (450 mm): Maximum span, 18 feet (5.4 m); minimum rod size, 1-1/4 inch (32 mm).

END OF SECTION
SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Air vents.
B. Strainers.
C. Balancing valves.
D. Combination flow controls.

1.02 RELATED REQUIREMENTS
A. Section 22 10 06 - Plumbing Piping Specialties: Backflow Preventers.
B. Section 23 21 13 - Hydronic Piping.
C. Section 23 25 00 - HVAC Water Treatment: Pipe Cleaning.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model.
C. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.
D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
E. Project Record Documents: Record actual locations of flow controls and flow meters.
F. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 EXTRA MATERIALS
A. See Section 01 6000 - Project Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 AIR VENTS
A. Manufacturers:
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Manual Type: Short vertical sections of 2 inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
   1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

E. Maximum Fluid Pressure: 150 psi (1,034 kPa).

F. Maximum Fluid Temperature: 250 degrees F (121.1 degrees C).

2.02 STRAINERS

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 2 inch (50 mm) and Under:
   1. Screwed brass or iron body for 175 psi (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm):
   1. Flanged iron body for 175 psi (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

D. Size 5 inch (125 mm) and Larger:
   1. Flanged iron body for 175 psi (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

2.03 BALANCING VALVES

A. Manufacturers:
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
   4. Tour and Andersson: www.tahydronics.com

B. Size 2 inch (50 mm) and Smaller:
   1. Provide globe or ______ style with flow balancing, flow measurement, 3/4" NPT hose end drain connection, and full shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
   2. Metal construction materials consist of bronze, brass, or Ametal.
   3. Non-metal construction materials consist of EPDM.

C. Size 2.5 inch (64 mm) and Larger:
   1. Provide globe style with flow balancing, flow measurement, 3/4" NPT hose end drain connection, and full shut-off capabilities and flanged, grooved, or weld end connections.
   2. Valve body construction materials consist of ductile iron.
   3. Internal components construction materials consist of brass, bronze, EPDM, or Ametal.

2.04 COMBINATION FLOW CONTROLS

A. Manufacturers:
   2. ITT Bell & Gossett: www.bellgossett.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi (24 kPa).

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

E. Accessories: In-line strainer on inlet and ball valve on outlet.

2.05 FLOW METERS

A. Manufacturers:
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Orifice principle by-pass circuit with direct reading gage, soldered or flanged piping connections for 125 psi (860 kPa) working pressure, with shut off valves, and drain and vent connections.

C. Direct reading with insert pitot tube, threaded coupling, for 150 psi (1034 kPa) working pressure, maximum 240 degrees F (115 degrees C), 5 percent accuracy.

D. Cast iron, wafer type, orifice insert flow meter for 250 psi (1720 kPa) working pressure, with read-out valves equipped with integral check valves with gasketed caps.

E. Calibrated, plug type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer.

F. Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and gasketed caps.

G. Portable meter consisting of case containing one, 3 percent accuracy pressure gage with 0-60 feet (0-180 kPa) pressure range for 500 psi (3450 kPa) maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

H. Portable meter consisting of case containing two, 3 percent accuracy pressure gages with 0-135 inches (0-34 kPa) and 0-60 feet (0-180 kPa) pressure ranges for 500 psi (3450 kPa) maximum working pressure, color coded hoses for low and high pressure connections, and connectors suitable for connection to read-out valves.

PART 3 EXECUTION
3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blow down connection.

G. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

H. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

I. Support pump fittings with floor mounted pipe and flange supports.
J. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

K. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.

L. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

M. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

N. Pipe relief valve outlet to nearest floor drain.

O. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

END OF SECTION
SECTION 23 81 01
TERMINAL HEAT TRANSFER UNITS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Unit ventilators.

1.02  RELATED REQUIREMENTS
A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
B. Section 23 21 13 - Hydronic Piping.
C. Section 23 21 14 - Hydronic Specialties.
D. Section 23 09 93 - Sequence of Operations for HVAC Controls.
E. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.03  SUBMITTALS
A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide typical catalog of information including arrangements.
C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
   3. Indicate mechanical and electrical service locations and requirements.
D. Manufacturer's Instructions: Indicate installation instructions and recommendations.
E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
F. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04  QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05  WARRANTY
A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B. Provide five year manufacturers warranty for all motors.
C. Provide one year parts and labor warranty for entire unit, from substitute and completion.

1.06  EXTRA MATERIALS
A. See Section 01 6000 - Product Requirements, for additional provisions.
B. Provide one (1) set of filters, with a final change immediately prior to occupancy.

PART 2  PRODUCTS

2.01  UNIT VENTILATORS
A. Manufacturers:
   2. York / JCI.
3. Airedale by Modine
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Coils: Copper tubes mechanically expanded into evenly spaced aluminum fins tested to operate at 150 psi (1034 kPa). Provide drain pan under cooling coil, easily removable for cleaning, with drain connection. Drain pan shall be stainless steel.

C. Cabinet: 0.0747 inch (1.9 mm) steel on solid base pan with exposed edges rounded. Provide removable front panels with quick-acting, key-operated cam locks. Provide removable die-cast or fabricated steel discharge grilles. For units having cooling coils, insulate internal parts and surfaces exposed to conditioned air stream with moisture resistant insulation.

D. Cabinet Accessories: Matching steel construction, reinforced, for use with unit ventilators or finned radiation, with steel alignment pins, adjustable kick plates with leveling bolts, shelves and sliding doors as indicated, corner, end, and wall filler sections as required.

E. Finish: Factory apply baked enamel of color as selected on visible surfaces of enclosure or cabinet.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven, arranged to draw air through coil.

G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

H. Control: Multiple speed switch, factory wired, located in cabinet, prepared for control by BAS.

I. Filter: Easily removed throw-away type with minimum efficiency reporting value (MERV) of at least 8.

J. Mixing Dampers: Multi-blade with compressible seal, capable of varying proportion of mixed air from 100 percent room air to 100 percent outside air.

K. Capacity: As Scheduled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Hydronic Units: Provide with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For cabinet unit heaters, fan coil units, and unit heaters, provide float operated automatic air vents with stop valve.

3.02 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION
SECTION 26 05 01
MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Electrical demolition.

1.02 RELATED REQUIREMENTS
A. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

PART 2 PRODUCTS
2.01 MATERIALS AND EQUIPMENT
A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify field measurements and circuiting arrangements are as shown on Drawings.
B. Verify that abandoned wiring and equipment serve only abandoned facilities.
C. Demolition drawings are based on casual field observation.
D. Report discrepancies to Owner before disturbing existing installation.
E. Report discrepancies to Architect before disturbing existing installation.
F. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION
A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
B. Coordinate utility service outages with utility company.
C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
A. Remove, relocate, and extend existing installations to accommodate new construction.
B. Remove abandoned wiring to source of supply.
C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
E. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
F. Repair adjacent construction and finishes damaged during demolition and extension work.
G. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
H. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR
A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.
B. Clean and repair existing materials and equipment that remain or that are to be reused.
C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

E. Any lighting or ceiling-mounted devices removed during construction must be reinstalled.

END OF SECTION
SECTION 26 05 19
LOW VOLTAGE ELEC. POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Single conductor building wire.
   B. Metal-clad cable.
   C. Wire and cable for 600 volts and less.
   D. Wiring connectors.
   E. Electrical tape.
   F. Heat shrink tubing.
   G. Wire pulling lubricant.
   H. Cable ties.

1.02 RELATED REQUIREMENTS
   A. Section 07 84 00 - Firestopping.
   B. Section 26 05 01 - Minor Electrical Demolition: Disconnection, removal, and/or extension of existing electrical conductors and cables.
   C. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
   D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS
   G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
   K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
   O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
C. Product Data: Provide for each cable assembly type.
D. Samples of Actual Product Delivered: Submit one 18 inch (450 mm) length of cable assembly from each reel.
   1. Select each length to include complete set of manufacturer markings.
   2. Attach tag indicating cable size and application information.
E. Test Reports: Indicate procedures and values obtained.
F. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.
G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
H. Project Record Documents: Record actual locations of components and circuits.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS
A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.
PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
C. Concealed Dry Interior Locations: Use only building wire in raceway type THHN/THHW.
D. Exposed Dry Interior Locations: Use only building wire in raceway type THHN/THHW.
E. Above Accessible Ceilings: Use only building wire in raceway type THHN.
F. Wet or Damp Interior Locations: Use only building wire in raceway type THW.
G. Exterior Locations: Use only building wire in raceway type THHW.
H. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
   I. Use solid conductors for control circuits.
   J. Use conductor not smaller than 12 AWG for power and lighting circuits.
   K. Use conductor not smaller than 16 AWG for control circuits.
   L. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (25 m).
   M. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet (60 m).

2.02 CONDUCTOR AND CABLE MANUFACTURERS

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
D. Comply with NEMA WC 70.
E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
G. Conductor Material:
   1. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
   2. Tinned Copper Conductors: Comply with ASTM B33.
H. Minimum Conductor Size: 12 AWG.
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
      2. Control Circuits: 14 AWG.
I. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.

3. Color Code:
   a. 480Y/277 V, 3 Phase, 4 Wire System:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral/Grounded: Gray.
   b. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   c. Equipment Ground, All Systems: Green.
   d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
   e. For control circuits, comply with manufacturer’s recommended color code.

2.04 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

F. Conductor: Copper.
   1. For Sizes Smaller Than 4 AWG: Copper.
   2. For Sizes 4 AWG and Larger: Copper.

G. Insulation Voltage Rating: 600 volts.

H. Insulation: NFPA 70, Type THHW/THWN/THHN/THW.

I. Insulation: Thermoplastic material rated 75/90 degrees C.

2.05 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   2. Size 8 AWG and Larger: Stranded.
D. Insulation Voltage Rating: 600 V.
E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
F. Provide dedicated neutral conductor for each phase conductor where indicated or required.
G. Grounding: Full-size integral equipment grounding conductor.
H. Armor: Steel, interlocked tape.
I. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.
J. Insulation Temperature Rating: 75/90 degrees C.

2.06 METAL CLAD CABLE
A. Description: NFPA 70, Type MC.
B. Conductor: Copper.
   1. For Sizes Smaller Than 4 AWG: Copper.
   2. For Sizes 4 AWG and Larger: Copper.
C. Insulation Voltage Rating: 600 volts.
D. Insulation Temperature Rating: 90 degrees C.
E. Insulation Material: Thermoplastic.
F. Armor Material: Steel.
G. Armor Design: Interlocked metal tape.
H. Jacket: PVC.

2.07 WIRING CONNECTORS
A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
B. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 WIRING ACCESSORIES
A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Vinyl Color Coding Electrical Tape: Integritly colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
   3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
   4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous
temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.

5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).

6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

1. Manufacturers:
   a. 3M: www.3m.com/#sle.

D. Cable Ties: Material and tensile strength rating suitable for application. Plenum rated cable ties for installation in plenums.

1. Manufacturers:
   b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Split Bolt Connectors: Description: Connector suitable for copper to copper connection tested and listed to UL 486A requirements. Black burn type-H or equal.

1. Product: Thomas R Betts or equal
2. Substitutions: See Section 01 60 00 - Product Requirements.

G. Spring Wire Connectors: Description: Flame retardant thermoplastic shell with plated steel square wire spring gated for 105 degrees C, 600 volts, Thomas and Betts fixed spring wire connectors or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated and routing is not shown, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
B. Install products in accordance with manufacturer’s instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer’s recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Exposed Cable Installation (only where specifically permitted):
   1. Route cables parallel or perpendicular to building structural members and surfaces.
   2. Protect cables from physical damage.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

I. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.
P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

S. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.

T. Route wire and cable as required to meet project conditions.
1. Wire and cable routing indicated is approximate unless dimensioned.
2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
3. Include wire and cable of lengths required to install connected devices within 10 ft (3000 mm) of location shown.

U. Use wiring methods indicated.

V. Pull all conductors into raceway at same time.

W. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

X. Protect exposed cable from damage.

Y. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

Z. Use suitable cable fittings and connectors.

AA. Neatly train and lace wiring inside boxes, equipment, and panelboards.

AB. Clean conductor surfaces before installing lugs and connectors.

AC. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

AD. Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

AE. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

AF. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

AG. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

AH. Identify and color code wire and cable under provisions of Section 26 0553. Identify each conductor with its circuit number or other designation indicated.

3.04 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 45 00.

B. Perform field inspection and testing in accordance with Section 01 45 00.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

E. Correct deficiencies and replace damaged or defective conductors and cables.

F. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION
SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.
D. Ground bars.
E. Grounding and bonding components.
F. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Existing metal underground water pipe.
   2. Metal frame of the building.
   3. Existing metal underground gas piping system.
   4. Metal underground gas piping system.

1.02  RELATED REQUIREMENTS

A. Section 26 05 19 - Low Voltage Elec. Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03  REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04  ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05  PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms.

1.06  SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.
D. Product Data: Provide for grounding electrodes and connections.
E. Test Reports: Indicate overall resistance to ground and resistance of each electrode.
F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual locations of components and grounding electrodes.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
   7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
      a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
      b. Metal gas piping.
      c. Metal process piping.
8. Provide bonding for interior metal air ducts.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

2.02 GROUNDING AND BONDING COMPONENTS
A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.
B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 05 19:
1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1) Use bare copper conductors where installed underground in direct contact with earth.
      2) Use bare copper conductors where directly encased in concrete (not in raceway).
C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
4. Manufacturers - Mechanical and Compression Connectors:
   d. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MANUFACTURERS
D. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 CONNECTORS AND ACCESSORIES
A. Mechanical Connectors: Bronze.
   1. Product: manufactured by Thomas and Betts or equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Wire: Stranded copper.
C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that work likely to damage grounding and bonding system components has been completed.
B. Verify that field measurements are as shown on the drawings.
C. Verify that conditions are satisfactory for installation prior to starting work.
D. Verify existing conditions prior to beginning work.
E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 05 53.

E. Provide bonding to meet requirements described in Quality Assurance.

F. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Each of branch circuits and feeder circuits shall have dedicated equipment grounding conductor, sharing this conductor with other grounding conductors is not permitted.

3.03 FIELD QUALITY CONTROL
A. Provide field inspection in accordance with Section 01 45 00.
B. Inspect and test in accordance with NETA ATS except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.13.
D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION
SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS
A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.
C. Section 26 05 37 - Boxes: Additional support and attachment requirements for boxes.
D. Section 26 25 13 - Low-Voltage Busways: Additional support and attachment requirements for busway.

1.03 REFERENCE STANDARDS
B. MFMA-4 - Metal Framing Standards Publication; 2004.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.05 SUBMITTALS
A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
D. Product Data: Provide manufacturer's catalog data for fastening systems.
E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
1.06 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Comply with applicable building code.
C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
D. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS
2.01 SUPPORT AND ATTACHMENT COMPONENTS
A. General Requirements:
1. Comply with the following. Where requirements differ, comply with most stringent.
   a. NFPA 70.
   b. Requirements of authorities having jurisdiction.
2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      d. Substitutions: See Section 01 60 00 - Product Requirements.
C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
   3. Channel Material:
      a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
   5. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
   6. Manufacturers:
      c. ___________.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch (13 mm) diameter.
      b. Busway Supports: 1/2 inch (13 mm) diameter.
      c. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch (6 mm) diameter.
      d. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch (10 mm) diameter.
      e. Trapeze Support for Multiple Conduits: 3/8 inch (10 mm) diameter.
      f. Outlet Boxes: 1/4 inch (6 mm) diameter.

F. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   7. Sheet Metal: Use sheet metal screws.
   8. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      b. Channel Material: Use galvanized steel.
      c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

2.02 MANUFACTURERS
   C. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MATERIALS
   A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
   B. Supports: Fabricated of structural steel or formed steel members; galvanized.
   C. Anchors and Fasteners:
      1. Do not use powder-actuated anchors.
2. Obtain permission from Architect before using powder-actuated anchors.
3. Concrete Structural Elements: Use precast inserts.
4. Steel Structural Elements: Use beam clamps.
5. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
7. Solid Masonry Walls: Use expansion anchors.

D. Formed Steel Channel:
   2. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field measurements are as shown on the drawings.
B. Verify that mounting surfaces are ready to receive support and attachment components.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.
C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
H. Conduit Support and Attachment: Also comply with Section 26 05 34.
I. Box Support and Attachment: Also comply with Section 26 05 37.
J. Busway Support and Attachment: Also comply with Section 26 25 13.
K. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
L. Secure fasteners according to manufacturer's recommended torque settings.
M. Remove temporary supports.

3.03 FIELD QUALITY CONTROL
A. See Section 01 40 00 - Quality Requirements, for additional requirements.
B. Inspect support and attachment components for damage and defects.
C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION
SECTION 26 05 34
CONDUIT

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Galvanized steel rigid metal conduit (RMC).
B. Flexible metal conduit (FMC).
C. Liquidtight flexible metal conduit (LFMC).
D. Electrical metallic tubing (EMT).
E. Conduit fittings.
F. Accessories.
G. Conduit, fittings and conduit bodies.

1.02  RELATED REQUIREMENTS
A. Section 07 84 00 - Firestopping.
B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
D. Section 26 0553 - Identification for Electrical Systems.
E. Section 26 05 37 - Boxes.

1.03  REFERENCE STANDARDS
A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
G. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
H. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
I. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
J. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
K. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.04  ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS
   A. See Section 01 33 00 - Administrative Requirements for submittals procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
   C. Shop Drawings:
      1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
      2. Include proposed locations of roof penetrations and proposed methods for sealing.
   D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.
   E. Product Data: Provide for metallic conduit and flexible metal conduit.
   F. Samples of Materials Actually Delivered to Site:
      1. Two pieces each of conduit, 2 feet (610 mm) long.
   G. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches (51 mm).

1.06 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
   C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
   D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
   B. Accept conduit on site. Inspect for damage.
   C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
   D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS
2.01 CONDUIT APPLICATIONS
   A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
   B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
   C. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
   D. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
   E. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
F. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.

C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      d. Substitutions: See Section 01 60 00 - Product Requirements.

   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

   3. Material: Use steel or malleable iron.

   4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 METAL CONDUIT

A. Manufacturers:
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

D. Description: Interlocked steel construction.

E. Fittings: NEMA FB 1.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

D. Description: Interlocked steel construction with PVC jacket.

E. Fittings: NEMA FB 1.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturers:
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.

D. Fittings and Conduit Bodies: NEMA FB 1; steel set screw type.

2.08 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

D. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
F. Description: NEMA TC 2.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field measurements are as shown on drawings.
B. Verify that mounting surfaces are ready to receive conduits.
C. Verify that conditions are satisfactory for installation prior to starting work.
D. Verify routing and termination locations of conduit prior to rough-in.
E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION
A. Install products in accordance with manufacturer’s instructions.
B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
D. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated and routing is not shown, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Arrange conduit to maintain adequate headroom, clearances, and access.
   6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   7. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
   8. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
   9. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
E. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
   4. Use conduit strap to support single surface-mounted conduit.
      a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
   5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
F. Connections and Terminations:
   1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

G. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

H. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

I. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

J. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

K. Provide grounding and bonding in accordance with Section 26 05 26.
3.03 FIELD QUALITY CONTROL
   A. See Section 01 40 00 - Quality Requirements, for additional requirements.
   B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
   C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING
   A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION
   A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.
   B. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1.
   C. Install steel conduit as specified in NECA 101.
   D. Install nonmetallic conduit in accordance with manufacturer's instructions.
   E. Arrange supports to prevent misalignment during wiring installation.
   F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
   G. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
   H. Fasten conduit supports to building structure and surfaces under provisions of Section 26 0529.
   I. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   J. Do not attach conduit to ceiling support wires.
   K. Arrange conduit to maintain headroom and present neat appearance.
   L. Route exposed conduit parallel and perpendicular to walls.
   M. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
   N. Route conduit in and under slab from point-to-point.
   O. Do not cross conduits in slab.
   P. Maintain adequate clearance between conduit and piping.
   Q. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
   R. Cut conduit square using saw or pipecutter; de-burr cut ends.
   S. Bring conduit to shoulder of fittings; fasten securely.
   T. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
   U. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
   V. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.
   W. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
   X. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
   Y. Provide suitable pull string in each empty conduit except sleeves and nipples.
Z. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
AA. Ground and bond conduit under provisions of Section 26 0526.
AB. Identify conduit under provisions of Section 26 0553.

3.06 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified in Section roofing section.

END OF SECTION
SECTION 26 05 37

BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Wall and ceiling outlet boxes.

D. Floor boxes.

E. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 27 26 - Wiring Devices: Wall plates.

F. Section 26 2726 - Wiring Devices: Wall plates in finished areas, floor box service fittings, fire-rated poke-through fittings, and access floor boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.


1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground handhole enclosures.
C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
D. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground handhole enclosures.
E. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS
2.01 BOXES
A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
12. Minimum Box Size, Unless Otherwise Indicated:
   a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
14. Manufacturers:
   e. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

2.02 MANUFACTURERS
B. Arc-Co./Division of Arcade Technology: www.arc-co.com.
D. Substitutions: Reco, Inc. See Section 01 60 00 - Product Requirements.
E. Steelcity

2.03 OUTLET BOXES
A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.
B. Nonmetallic Outlet Boxes: NEMA OS 2.
C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
D. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.04 PULL AND JUNCTION BOXES
A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron; Cast Aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
   1. Material: Galvanized cast iron; Cast Aluminum.
   2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend: "ELECTRIC".

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as shown on drawings.
   B. Verify that mounting surfaces are ready to receive boxes.
   C. Verify that conditions are satisfactory for installation prior to starting work.
   D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
   C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
   D. Box Supports:
      1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
      2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   E. Install boxes plumb and level.
   F. Flush-Mounted Boxes:
      1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
      2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
      3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
   G. Install boxes as required to preserve insulation integrity.
   H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
   I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
   J. Close unused box openings.
   K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
   L. Provide grounding and bonding in accordance with Section 26 05 26.
M. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
N. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
O. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.
P. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
Q. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
  1. Adjust box locations up to 10 feet (3 m) if required to accommodate intended purpose.
R. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.
S. Maintain headroom and present neat mechanical appearance.
T. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
U. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
V. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
W. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
X. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
Y. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
Z. Use flush mounting outlet box in finished areas.
AA. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
AB. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic rated walls.
AC. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
AD. Use stamped steel bridges to fasten flush mounting outlet box between studs.
AE. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
AF. Use adjustable steel channel fasteners for hung ceiling outlet box.
AG. Do not fasten boxes to ceiling support wires.
AH. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches (305 mm) of box.
AI. Use gang box where more than one device is mounted together. Do not use sectional box.
AJ. Use gang box with plaster ring for single device outlets.
AK. Use cast outlet box in exterior locations exposed to the weather and wet locations.
AL. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
AM. Set floor boxes level.
AN. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING
A. Adjust floor boxes flush with finish flooring material.
B. Adjust flush-mounting outlets to make front flush with finished wall material.
C. Install knockout closures in unused box openings.
3.04 CLEANING
   A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.05 PROTECTION
   A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION
SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Warning signs and labels.
F. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS
A. Section 09 90 00 - Painting and Coating.
B. Section 26 05 19 - Low Voltage Elec. Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
C. Section 26 27 26 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS
A. See Section 01 33 00 - Administrative Requirements for submittals procedures.
B. Product Data: Provide catalog data for nameplates, labels, and markers.
C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.

1.07 EXTRA MATERIALS
A. See Section 01 6000 - Product Requirements for additional requirements.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS
A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Panelboards:
         1) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         2) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location when not within sight of equipment.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
      b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
      c. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
   3. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
   4. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

C. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
   3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
      a. At each source and load connection.
      b. Within boxes when more than one circuit is present.
      c. Within equipment enclosures when conductors and cables enter or leave the enclosure.

D. Identification for Raceways:
   1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).
   2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet (6.1 m).
      a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
         1) Color Code:
         2) Field-Painting: Comply with Section 09 90 00.
         3) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
   3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.

E. Identification for Boxes:
   1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 09 90 00 per the same color code used for raceways.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
   a. For exposed boxes in public areas, use only identification labels.

F. Identification for Devices:
   1. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.

2.02 MANUFACTURERS
D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 IDENTIFICATION NAMEPLATES AND LABELS
A. Identification Nameplates:
   1. Manufacturers:
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
      a. Exception: Provide minimum thickness of 1/8 inch (3 mm) when any dimension is greater than 4 inches (100 mm).
   4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Manufacturers:
      d. Substitutions: See Section 01 60 00 - Product Requirements.
      a. Use only for indoor locations.
   3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch (6 mm).
5. Color: Black text on white background unless otherwise indicated.

D. Format for Control Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

E. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

F. Locations:
1. Each electrical distribution and control equipment enclosure.
2. Communication cabinets.
3. Disconnect switches, and starters.

G. Letter Size:
1. Use 1/8 inch (3 mm) letters for identifying individual equipment and loads.
2. Use 1/4 inch (6 mm) letters for identifying grouped equipment and loads.

2.04 WIRE AND CABLE MARKERS

A. Manufacturers:
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch (3 mm).

G. Color: Black text on white background unless otherwise indicated.

H. Description: split sleeve type wire markers.

I. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

J. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number indicated on shop drawings.

2.05 VOLTAGE MARKERS

A. Manufacturers: Panduit Corp
1. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:

F. Color: Black text on orange background unless otherwise indicated.

G. Location: Furnish markers for each conduit longer than 6 feet (2 m).

H. Spacing: 20 feet (6 m) on center.

I. Color:
1. 480 Volt System: Brown.
2. 208 Volt System: Yellow.

J. Legend:
1. 480 Volt System: brown.
2. 208 Volt System: yellow.

2.06 WARNING SIGNS AND LABELS

A. Manufacturers:
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   a. Do not use labels designed to be completed using handwritten text.
   b. Provide polyester overlaminate to protect handwritten text.
3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.
D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
F. Secure rigid signs using stainless steel screws.
G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION
SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Power distribution panelboards.
   B. Lighting and appliance panelboards.
   C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS
   A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
   E. Section 26 28 13 - Fuses: Fuses for fusible switches and spare fuse cabinets.

1.03 REFERENCE STANDARDS
   A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.
   B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
   C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.
   E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
   F. NEMA PB 1 - Panelboards; 2011.
   G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
   I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
      2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
      3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
      4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
   A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS
A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1.09 MAINTENANCE MATERIALS
A. See Section 01 6000 - Product Requirements, for additional provisions.
B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.01 MANUFACTURERS
C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
D. Substitutions: See Section 01 60 00 - Product Requirements.
2.02 PANELBOARDS - GENERAL REQUIREMENTS
   A. Provide products listed, classified, and labeled as suitable for the purpose intended.
   B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
      1. Altitude: Less than 6,600 feet (2,000 m).
      2. Ambient Temperature:
   C. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
   D. Conductor Terminations: Suitable for use with the conductors to be installed.

2.03 OVERCURRENT PROTECTIVE DEVICES
   A. Molded Case Circuit Breakers:
      1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      2. Interrupting Capacity:
         a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
            1) 14,000 rms symmetrical amperes at 240 VAC or 208 VAC.
            2) 21,000 rms symmetrical amperes at 480 VAC.
         b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
         c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
      3. Conductor Terminations:
         a. Provide mechanical lugs unless otherwise indicated.
         b. Lug Material: Copper, suitable for terminating copper conductors only.
      4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
         a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
         b. Provide interchangeable trip units where indicated.
      5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
      6. Do not use tandem circuit breakers.
      7. Do not use handle ties in lieu of multi-pole circuit breakers.

2.04 SOURCE QUALITY CONTROL
   A. See Section 01 40 00 - Quality Requirements, for additional requirements.
   B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that field measurements are as shown on the drawings.
   B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
   C. Verify that mounting surfaces are ready to receive panelboards.
   D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
C. Provide required supports in accordance with Section 26 05 29.
D. Provide grounding and bonding in accordance with Section 26 05 26.
E. Install all field-installed branch devices, components, and accessories.
F. Provide filler plates to cover unused spaces in panelboards.
G. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.
H. Identify panelboards in accordance with Section 26 05 53.
I. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

3.03 FIELD QUALITY CONTROL
A. Perform inspection, testing, and adjusting in accordance with Section 01 45 00.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Test GFCI circuit breakers to verify proper operation.
D. Correct deficiencies and replace damaged or defective panelboards or associated components.
E. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.04 ADJUSTING
A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
B. Adjust alignment of panelboard fronts.

END OF SECTION
SECTION 26 27 17
EQUIPMENT WIRING

PART 1  GENERAL
1.01  SECTION INCLUDES
A.  Electrical connections to equipment.

1.02  RELATED REQUIREMENTS
A.  Section 26 05 34 - Conduit.
B.  Section 26 05 19 - Low Voltage Elec. Power Conductors and Cables (600 V and Less).
C.  Section 26 05 37 - Boxes.
D.  Section 26 27 26 - Wiring Devices.

1.03  REFERENCE STANDARDS
A.  NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
B.  NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
C.  NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04  SUBMITTALS
A.  See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B.  Product Data:  Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
C.  Manufacturer's Instructions:  Indicate application conditions and limitations of use stipulated by product testing agency.  Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05  QUALITY ASSURANCE
A.  Conform to requirements of NFPA 70.
B.  Products:  Listed, classified, and labeled as suitable for the purpose intended.

1.06  COORDINATION
A.  Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
B.  Determine connection locations and requirements.
C.  Sequence rough-in of electrical connections to coordinate with installation of equipment.
D.  Sequence electrical connections to coordinate with start-up of equipment.

PART 2  PRODUCTS
2.01  MATERIALS
A.  Cords and Caps:  NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1.  Colors:  Conform to NEMA WD 1.
   2.  Cord Construction:  NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3.  Size:  Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
   4.  Product:
   5.  Substitutions:  See Section 01 60 00 - Product Requirements.
B.  Disconnect Switches:  As specified in Section and in individual equipment sections.
C.  Wiring Devices:  As specified in Section 26 27 26.
D.  Flexible Conduit:  As specified in Section 26 05 34.
E. Wire and Cable: As specified in Section 26 05 19.
F. Boxes: As specified in Section 26 05 37.

2.02 EQUIPMENT CONNECTIONS
   A. As required by equipment manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS
   A. Make electrical connections in accordance with equipment manufacturer's instructions.
   B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
   C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
   D. Provide receptacle outlet to accommodate connection with attachment plug.
   E. Provide cord and cap where field-supplied attachment plug is required.
   F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
   G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
   H. Install terminal block jumpers to complete equipment wiring requirements.
   I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
   J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION