PROJECT MANUAL

Payette School District #381
Career Technical Education Building
Payette, Idaho

Prepared by
Hutchison Smith Architects
January 14, 2025

915 S. Main Street
Payette Idaho 83661
Project Number 24.106

CONTSTRUCTION ESTIMATE 1-14-25

SPECIFICATIONS & DETAILS

Career Technical Education Building

For

Payette School District #371
1312 1st Avenue N
Payette, Idaho 83661

DATE: January 14, 2025

ARCHITECT
Hutchison-Smith Architects
270 N. 27th St., Suite A
Boise, ID 83702
Contact: Glenn Robinette
Tel: (208) 338-1212

STRUCTURAL ENGINEER
Ally Structural Consulting LLC
3778 Plantation River, Suite 102
Boise, ID 83703
Contact: Craig Brasher
Tel: (208) 949-5993

MECHANICAL ENGINEER
Nielson Engineering
156 N. 12th Avenue
Pocatello, ID 83201
Contact: Gordon A. Nielson
Tel: (208) 232-2577

ELECTRICAL ENGINEER
Nielson Engineering
156 N. 12th Avenue
Pocatello, ID 83201
Contact: Michael S. Inskeep
Tel: (208)232-2577

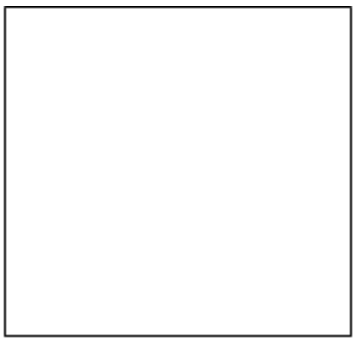
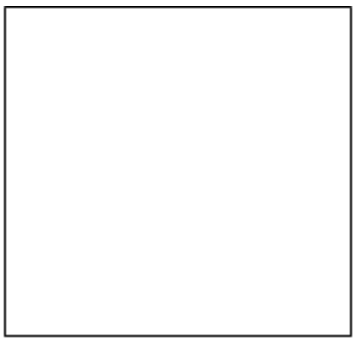
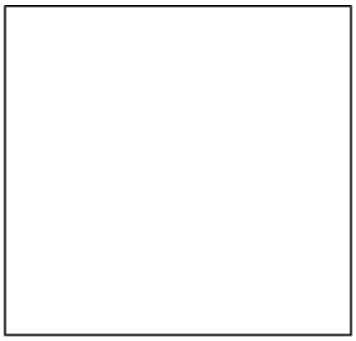
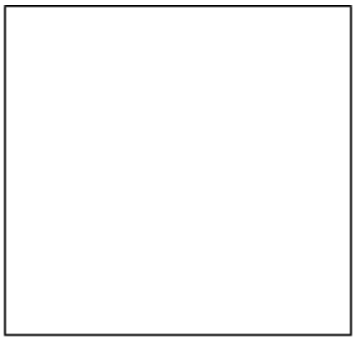





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INSTRUCTIONS TO BIDDERS

AIA Document A701, Instruction to Bidders, 2018 Edition is hereby included by reference and shall be a part of the Contract Documents. Copies of AIA Document A701 are available for review at the offices of the Architect and at https://aiacontracts.com.

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following supplements modify, change, delete from or add to the Instructions to Bidders, AIA Document A701 - 1997. Where any Article of the Instructions to Bidders is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by the Supplementary Instructions to Bidders, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

ARTICLE 2 BIDDERS REPRESENTATIONS

2.1.2 Delete the period and add a comma and add the following;

and with a full understanding of the schedule, phasing, existing site constraints, material availability, or any other construction-related issues that may affect the project.

ARTICLE 3 BIDDING DOCUMENTS

3.1.3 Add after….in any other manner, including the telephone or e-mail.

3.2.3 Add after….in any other manner, including the telephone or e-mail.

ARTICLE 4 BIDDING PROCEDURES

Add to or supplement Article 4, the following:

4.1.1 A photocopy of the form bound in the Project Manual or a modified form included in an addendum is acceptable.

4.1.7 A corporate seal is not required if not required by the state of incorporation.

Delete the last sentence.

4.2.1.1 To be considered, proposals must be accompanied by an acceptable security, in an amount not less than five (5) percent of the total amount of the bid including add alternates. The security may be in the form of a bond, or a certified or cashier's check.

4.2.1.2 A successful bidder who fails to sign the contract for the work or furnish the required bonds within 10 days following the receipt of notice of intent to award a contract, shall forfeit the security. The owner may then award the contract to the next lowest bidder.

4.2.3.1 The specified time for retainage of the bid security is 60 days after the opening of bids, so long as the bidder has not been notified of the acceptance of the bid.

4.3.1.1 The mailing envelope containing the bid shall be addressed as follows:

Tenant Improvement for CTE Building
Payette School District
915 S. Main Street
Payette, ID 83661

Payette School District #371
20 N. 12th Street
Payette, ID 83661

Bidders are required to use Sealed Bid Label included in the Specification. Cut off and apply to front of Bid envelope.

ARTICLE 5 CONSIDERATION OF BIDS

5.4 PUBLIC WORKS CONTRACTORS LICENSE

This Public Works project is not financed in whole or in part by Federal Aid Funds. Bid Proposals will be accepted from those contractors only (prime contractors, subcontractors, and/or specialty contractors) who, prior to the bid opening, hold current licenses as public works contractors in the State of Idaho.

5.5 IDAHO DOMICILED CONTRACTORS

BIDDER DOMICILED OUTSIDE OF IDAHO - Any contract for purchase of any materials, supplies, services or equipment, the bidder domiciled outside the boundaries of Idaho shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by the responsible bidder domiciled in Idaho as would be required for such an Idaho domiciled bidder to succeed over the bidder domiciled outside Idaho on a like contract being let in his domiciliary state.

ARTICLE 6 POST BID INFORMATION

Delete paragraph 6.2

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

Modify and add to Article 7, the following:

In paragraph 7.2.1, in the first sentence, delete the word “three” and insert “five” days following the word “date”, delete the rest of the paragraph and insert the following: “the contractor receives a faxed copy of the contract and the Notice of Acceptance.”

7.2.2.1 Performance bond and labor and material payment bond are required for this project; each in an amount of not less than 100% of the contract amount, and by a surety company authorized to do business in Idaho.

END OF SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

BID PROPOSAL

TO: PAYETTE SCHOOL DISTRICT #371
1312 1st Ave. N.
Payette, Idaho 83661

Persons:

The Bidder, in compliance with your invitation for bids for **Tenant Improvement CTE Building Payette School District 915 S Main Street Payette, ID ,** of the Payette School District #371, having examined the plans and specifications with related documents and the site of the proposed work, and being familiar with all the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies, and to provide the service and insurance in accordance with the Contract Documents, within the time set forth therein, and the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this proposal is part, including the Building Permit fee. Plan Review fee is paid for by the Owner.

Bidder hereby agrees to commence work under this contract on a date to be specified in the Notice to Proceed from the Owner and to substantially complete the project within 180 consecutive calendar days thereafter, as stipulated in the specifications. The Bidder further agrees to pay as liquidated damages, the sum of $350.00 for each consecutive calendar day after the established substantial completion date or adjusted date as established by change order.

Bidder acknowledges receipt of the Addendum No(s)._____.

BASE BID: Bidder agrees to perform all of this work as described in the specifications and shown on the plans for the sum of:

_____

Dollars ($ _____) (Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

Alternate No. 1: Portion B as indicated on drawings and all associated items.

Add the sum of _____ Dollars ($_____)

Bidder understands that the Owner reserves the right to reject any or all Bids and to waive any informalities in the bidding. The Bidder agrees that this Bid shall be good and may not be withdrawn for a period of 30 calendar days after the scheduled closing time for receiving bids.

Upon receipt of written notice of the acceptance of this Bid, Bidder will execute the formal contract attached within ten (10) days and deliver a Surety Bond or Bonds as required by Article 7 of the Instructions to Bidders, including paragraph 7.1.1 and 7.2.1 of the Supplementary Instructions to Bidders.

The bid security attached in the amount of 5% of the bid amount is to become the property of the Owner in the event the contract and bond are not executed within the time above set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

The Undersigned notifies that he is of this date duly licensed as an Idaho Public Works Contractor and further that he possess Idaho Public Works Contractor's License No. _____, and is domiciled in the State of _____.

Dated this _____ day of _____ 20___.

Respectfully submitted,

By:_____
(Company)

_____
(Business Address)

_____

_____
(Seal - if bid is by a Corporation) (Authorized Signature)

_____
(Title)

_____
(Telephone Number)

END OF BID PROPOSAL

PAYETTE SCHOOL DISTRICT
BIDDER CERTIFICATION FORM

1. **Debarment and Suspension** – In submitting this bid proposal, we hereby certify that we have not been suspended or in any way excluded from Federal procurement actions by any Federal Agency. We fully understand that if information contrary to this certification subsequently becomes available, such evidence may be grounds for non-award or nullification of a bid contract.

2. **Anti-Collusion** – In submitting this bid proposal, we hereby certify this proposal was developed and prepared without any collusion with any competing bidder or District employee. The content of this proposal has not been disclosed to any competing or potentially competing bidder prior to the proposal due date and time. Furthermore, no action to persuade any person, partnership or corporation to submit or withhold a bid has been made.

3. **Anti-Lobbying** – In submitting this bid proposal, we hereby certify that to the best of our knowledge and belief, no appropriated Federal funds have been paid or will be paid by or on behalf of person associated with this proposal to any person for influencing or attempting to influence and officer or employee of any agency, a member of Congress, an office or employee of Congress or an employee of a member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan or cooperative agreement.

4. **National Sexual Offender Registry** – In submitting this bid proposal, you certify to the District that your company will prohibit any persons in your employ who are registered or required to register under the Idaho Sex Offender Registration Act from participation in company business with the District if such participation would require them to be present on school property. You certify further that you have cross checked such employees against the National Sex Offender Registry found at the following web link: http://www.nsopr.gov/

5. **Israeli Related Boycotts** – In submitting this bid proposal and in accordance with Idaho Code 67-2346, the Contractor certifies it does not, and will not for the life of this contract, boycott goods or services from Israel or from territories under the control of Israel.

6. **Ownership or Operation by China** – In submitting this bid and in accordance with Idaho Code 67-2359, the Contractor certifies it is not currently owned or operated by the government of China and will not for the duration of the Contract be owned or operated by the government of China.

Signed: _____

Name & Title: _____

Company: _____

Address: _____

City & State: _____

Date: _____

CONTRACTORS AFFIDAVIT CONCERNING TAXES

STATE OF_____

COUNTY OF_____

Pursuant to the Idaho Code, Title 63, Chapter 15, I, the undersigned, beings duly sworn, depose and certify that all taxes, excise and license fees due to the State of Idaho and its taxing units, for which I or my property is liable, then due or delinquent, have been paid, or arrangements have been made, before entering into a contract for construction of any public works in the State of Idaho

_____
Name of Contractor

_____
Address

_____
City and State

By _____
Authorized Representative

Subscribed and sworn to before me this_____day of_____, _____.

_____
Notary Public, residing at

_____

Commission expires:_____

CONTRACTOR'S AFFIDAVIT
CONCERNING ALCOHOL AND DRUG-FREE WORKPLACE

STATE OF _____

COUNTY OF _____

Pursuant to the Idaho Code, Section 72-1717, I, the undersigned, being duly sworn, depose and certify that_____ is in compliance with the provisions of Idaho Code section 72-1717; that _____provides a drug-free workplace program that complies with the provisions of Idaho Code, title 72, chapter 17 and will maintain such program throughout the life of a state construction contract and that _____ shall subcontract work only to subcontractors meeting the requirements of Idaho Code, section 72-1717(1)(a).

_____
Name of Contractor

_____
Address

_____
City and State

By: _____
(Signature)

Subscribed and sworn to before me this _____day of _____ _____

Commission expires:

_____
NOTARY PUBLIC, residing at

_____

_____

CONTRACTORS AFFIDAVIT OF PAYMENT OF DEBTS AND CLAIMS

AIA Document G706, Contractors Affidavit of Payment of Debts and Claims is hereby included by reference and shall be a part of the Contract Documents. Copies of AIA Document G706 are available for review at the offices of the Architect. Copies of the document may be purchased from the American Institute of Architects at https://aiacontracts.com.

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

AIA Document G707, Consent of Surety Company to Final Payment is hereby included by reference and shall be a part of the Contract Documents. Copies of AIA Document G707 are available for review at the offices of the Architect. Copies of the document may be purchased from the American Institute of Architects https://aiacontracts.com.

IDAHO State Tax Commission

Form WH-5
Public Works Contract Report

Contractors awarded Idaho public works contracts must submit this form to the Tax Commission within 30 days of receiving the award. (Idaho Code sections 54-1904A and 63-3624(g)).

Contract awarded by (public body and address)

Contract awarded to (contractor's name and address)

State of incorporation	Federal Employer Identification Number (EIN)	Date qualified to do business in Idaho
Business operates as ☐ Sole Proprietorship ☐ Partnership ☐ Corporation ☐ LLC		Public works contractor license number
Sole proprietor's Social Security number	Idaho sellers permit number	Idaho withholding tax permit number
Awarding agency project number		Amount of contract $

Description and location of work to be performed

Project Dates

Scheduled project start date: _____ Completion date: _____

If the following information isn't available at this time, please enter date it will be: _____

All Subcontractors

Name			Federal EIN
Address			Public works contractor license number
City	State	ZIP Code	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor license number
City	State	ZIP Code	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor number
City	State	ZIP Code	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor license number
City	State	ZIP Code	Amount of subcontract $
Description of work			

All Subcontractors (*continued*)

Name			Federal EIN
Address			Public works contractor license number
City	State	ZIP Code	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor license number
City	State	ZIP Code	Amount of subcontract $
Description of work			

Name			Federal EIN
Address			Public works contractor license number
City	State	ZIP Code	Amount of subcontract $
Description of work			

Suppliers

List your major suppliers of materials, equipment, and supplies. Include items removed from inventory and items provided to you by the government agency for use in this project.

Name		Federal EIN	Total value $
Address		Materials and equipment purchased and used	
City, State, ZIP Code	Phone number	Please select how sales or use tax was paid. ☐ Tax paid to supplier ☐ Tax paid to state* ☐ No tax was paid	

Name		Federal EIN	Total value $
Address		Materials and equipment purchased and used	
City, State, ZIP Code	Phone number	Please select how sales or use tax was paid. ☐ Tax paid to supplier ☐ Tax paid to state* ☐ No tax was paid	

Name		Federal EIN	Total value $
Address		Materials and equipment purchased and used	
City, State, ZIP Code	Phone number	Please select how sales or use tax was paid. ☐ Tax paid to supplier ☐ Tax paid to state* ☐ No tax was paid	

*If you're reporting any untaxed materials, equipment, or supplies as "items subject to use tax" on your Idaho return, provide the period when you did or will report it: _____

If you paid tax to a state other than Idaho, write the name state next to "total value" boxes, above. For any tax due that you haven't reported yet, include payment with this form. You can make copies of this form is you need more room.

Sign Here	Authorized signature	Print name	Phone number	Date

File with the Idaho State Tax Commission, PO Box 36, Boise ID 83722-0410

For more information, call (208) 334-7618 | Fax: (208) 332-6619 | Email: **contractdesk@tax.idaho.gov**

AGREEMENT BETWEEN OWNER AND CONTRACTOR

AIA Document A101, 2017 Edition, Standard Form of Agreement Between Owner and Contractor will be used as the agreement for this project. Copies of AIA Document A101 are available for review at the office of the Architect. Copies of the document may be purchased from the American Institute of Architects at https://aiacontracts.com.

GENERAL CONDITIONS

AIA Document A201, General Conditions of the Contract for Construction, 2017 Edition is hereby included by reference and shall be a part of the Contract Documents. Copies of AIA Document A201 are available for review at the office of the Architect and available at https://aiacontracts.com.

SUPPLEMENTARY GENERAL CONDITIONS

The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201, 2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 2 OWNER

2.1 General

Delete subparagraph 2.1.2

2.3 Information and Services Required of the Owner

Delete subparagraph 2.3.6 and substitute the following:

2.3.6 The Contractor will be furnished free of charge 5 copies of Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage and handling.

ARTICLE 3 CONTRACTOR

3.7 Permits, Fees and Notices and Compliance with Laws

Add to 3.7.1 the following:

3.7.1.1 A Building Permit is required for this project. The Contractor shall obtain and pay for all licenses and permits and shall pay all fees and charges for connections to outside services and for the use of municipal or private property for storage of materials, parking, utility services, temporary obstructions, enclosures, opening and patching of streets, etc., off of the property of the Owner arising from the construction and completion of the Work. The Contractor is not responsible for and will not be required to pay impact fees, sewer capacity fees and similar forms of taxes imposed by local taxing bodies.

Modify 3.7.3 as follows:

a. Remove the phrase “knowing it to be “ from 3.7.3
b. At the end of the first sentence 3.7.3 add the phrase “unless specifically directed to do so by the Contract Documents.”
c. Add the following sentence to the end of 3.7.3: “If the Contractor is aware or suspects that work shown in the Contract Documents is or may be contrary o applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall notify the Architect immediately and prior to construction of the work in question and request information and/or clarification.”

ARTICLE 7 CHANGES IN THE WORK

7.2 Change Orders

Add to 7.2 the following:

7.2.2 Any Change Order prepared, including but not limited to those arising by reason of the parties’ mutual agreement or by mediation, shall constitute a final and full settlement of all matters relating to or affected by the change in the work, including, but not limited to, all direct, indirect and consequential costs associated with such change and any and all adjustments to the Contract Sum and Contract Time. In the event a Change Order increases the Contract Sum, the Contractor shall include the work covered by such Change Order in the Application for Payment as if such work were originally part of the Project and Contract Documents.

7.2.3 By the execution of a Change Order, the Contractor agrees and acknowledges that he has had sufficient time and opportunity to examine the change in work which is the subject of the Change Order and that he has undertaken all reasonable efforts to discover and disclose any concealed or unknown conditions which may to any extent affect the Contractor's ability to perform in accordance with the Change Order. Aside from those matters specifically set forth in the Change Order, the Owner shall not be obligated to make any adjustments to either the Contract Sum or Contract Time by reason of any conditions affecting the change in work addressed by the Change Order which could have reasonably been discovered or disclosed by the Contractor's examination.

7.3 Construction Change Directives

Add to subparagraph 7.3.5 the following:

In the second line after the word "claim" insert the following words: "in writing within forty-eight hours ".... The balance of the subparagraph remains unchanged.

In subparagraph 7.3.7, in the last sentence, delete "recorded as a" and substitute "incorporated into a future". In subparagraph 7.3.9 delete the last two sentences.

ARTICLE 8 TIME

8.1 Definitions

Add to subparagraph 8.1.1 the following:

8.1.1.1 The Contractor shall substantially complete the work as indicated in the Bid Proposal.

8.3 Delays and Extensions of Time

Add to 8.3 the following:

8.3.4 If the Contractor submits a progress report or schedule indicating, or otherwise expressing an intention to achieve completion of the Work prior to any completion date required by the Contract Documents or expiration of the Contract Time, no liability of the Owner to the Contractor for any failure of the Contractor to so complete the Work shall be created or implied.

ARTICLE 9 PAYMENTS AND COMPLETION

9.3 Applications for Payment

In subparagraph 9.3.1, in the first sentence, delete the words "At least ten days" and substitute the following:

"At least 2 days before the date of the monthly progress meeting, but not more than thirty days"

Delete subparagraph 9.3.1.1.

Add 9.3.1.3 The form of Application for Payment shall be AIA Form 706 and 707, or a pre-approved contractor's form containing the same line items. Submit one original.

Delete the last two sentences of 9.3.2 regarding payment of materials and equipment stored off site, and replace with the following: "payment for offsite storage will not be approved."

9.6 Progress Payments

Add to 9.6.1 the following:

9.6.1.1 Until conditions set forth in paragraph 9.10 are met, the Owner shall pay ninety-five percent (95%) of the amount due the Contractor on account of progress payments. If the Architect determines that the Contractor has made or is making satisfactory progress on any uncompleted portions of the work, the Owner may, at its discretion, release a portion of the retainage to the Contractor prior to the actual final completion of the conditions set forth in Paragraph 9.10.

9.6.1.2 Progress Payments shall fall due twenty-one (21) days after the Architects Certificate for Payment is received by the Owner.

Add to 9.6.2 the following:

9.6.2.1 The Contractor shall not withhold from a subcontractor or supplier more than the percentage withheld from a payment certificate for the subcontractor or suppliers portion of the work.

9.8 Substantial Completion

In subparagraph 9.8.5 delete the last two sentences.

9.10 Final Completion and Final Payment

Add to 9.10.1 the following:

9.10.1.1 The final retainage shall become due and payable to the Contractor in not more than thirty (30) days after issuance of the final Certificate for Payment by the Architect, provided that the conditions of subparagraph 9.10.2 are fully satisfied.

Add to Article 9 the following:

9.11 Liquidated Damages

9.11.1 The Owner will suffer financial loss in an amount that is difficult to quantify if the Project is not Substantially Complete on the date set forth in the Contract Documents. The Contractor (and his Surety) shall be liable for and shall pay to the Owner the sums hereinafter stipulated as fixed, agreed and liquidated damages, and not as a penalty, for each calendar day of delay until the Work is substantially completed:

Three hundred fifty DOLLARS ($ 350.00)

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.2 Safety of Persons and Property

Add to 10.2.4 the following:

10.2.4.1 The Contractor shall give the Owner 5 days advance written notice of his intent and receive approval prior to beginning the work.

10.3 Hazardous Materials

Add to 10.3.1 the following:

10.3.1.1 Reference to asbestos or polychlorinated biphenyl (PCB) in this Article does not negate the appropriate abatement of asbestos and PCB containing materials as specifically required by the Contract Documents.

ARTICLE 11 INSURANCE AND BONDS

11.1 Contractor's Liability Insurance

Add to 11.1.1 the following:

The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits:

1. Workers' Compensation:

(a)	State:	Statutory
(b)	Employer's Liability:	$100,000 per Accident $500,000 Disease, Policy Limit $100,000 Disease, Each Employee

2. Comprehensive or commercial general liability including premises operation; owners and contractors protective liability, products and completed operations liability, personal injury liability (including employee acts), broad form property damage liability and blanket contractual liability:

(a) For any claim for bodily injury, property damage or due to a contractual liability, limits of not less than $1 million per occurrence.

(b) For products and completed operations coverage, coverage is to be maintained for a period of two (2) years following final payment.

(c) For the hazards of explosion, collapse, and underground, commonly referred to as XCU, coverage shall be required if the exposures exist. This coverage may be provided by the subcontractor if the State and prime contractor are named as additional insureds.

(d) For personal injury liability, limits of not less than $100,000 per occurrence.

3. Business auto liability (including owned, non-owned and hired vehicles) in an amount of not less than $1 million combined single limit.

4. If the General Liability coverages are provided by a Commercial Liability policy, the:

(a) General Aggregate shall be not less than $2,000,000.

(b) Fire legal liability shall be provided in an amount not less than $50,000 per occurrence.

5. Umbrella Excess Liability:

An umbrella policy may be used in combination with other policies to provide a minimum coverage of $1,000,000.

11.1.2.2 The Owner shall be named as an additional insured on the insurance required in 11.1.2.1 items 2, 3 and 5 above and the insurance shall contain the severability of interest clause as follows:

"The insurance afforded herein applies separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the company's 'liability'."

11.1.2.3 The Contractor shall require all subcontractors of any tier to provide Commercial General Liability Insurance with liability limits of not less than $1,000,000 for bodily injury and property damage, and Business Automobile Liability Insurance for all owned, non-owned and hired vehicles with liability limits of not less than $1,000,000.

Add to 11.1.3 the following:

11.1.3.1 If this insurance is written on the Comprehensive General Liability policy form, the Certificates shall be AIA Document G705, Certificate of Insurance of ACORD form 25. If this insurance is written on a Commercial General Liability policy form, ACORD form 25S will be acceptable.

11.3 Property Insurance

Delete subparagraph 11.3.1 and substitute the following:
11.3.1 The owner maintains an insurance program of property insurance supplemented by an insurance policy sufficient to cover the total insurable value of this project. This insurance program covers the interests of the State of Idaho.

Delete subparagraphs 11.3.1.1, 11.3.1.2, 11.3.1.3, 11.3.1.4 and 11.3.1.5 and substitute the following:

Add to Article 11 the following:

11.5 Indemnity

11.5.1 The Contractor shall indemnify, defend and save harmless the Owner, the Architect, and the Architect's Consultant from and against all claims, damages, costs, legal fees, expenses, actions and suits whatsoever including injury or death of others or any employee of the Contractor, subcontractors, or the sub-subcontractors, agents or employees, caused by failure to comply fully with any term or condition of the Contract, or caused by damage to or loss of use of property, directly, or indirectly, by the carrying out of the work, or caused by any matter or thing done, permitted or omitted to be done by the Contractor, his agents, subcontractors or employees and occasioned by the negligence of the Contractor, his agents, subcontractors or employees.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

12.2 Correction of Work

In subparagraph 12.2.2.1 delete the second sentence.

ARTICLE 13 MISCELLANEOUS PROVISIONS

13.1 Governing Law

In paragraph 13.1 after the word "located" delete the balance of the sentence.

Add to 13.1 the following:

13.1.1 Each Contractor and his subcontractors and sub-subcontractors shall comply with all Idaho Statutes with specific reference to Public Works Contractor's State License Law, Title 54, Chapter 19, Idaho Code, as amended.

13.1.2 Pursuant to Sections 44-1001 and 44-1002, Idaho Code, it is provided that each Contractor "must employ ninety-five percent (95%) bona fide Idaho residents as employees, except where under such contracts fifty or less persons are employed, the Contractor may employ ten percent (10%) non-residents, provided, however, in all cases employers must give preference to the employment of bona fide residents in the performance of said work, and no contract shall be let to any person, firm, association or corporation refusing to execute an agreement with the above-mentioned provisions in it; provided that in contracts involving the expenditure of Federal Aid Funds this act shall not be enforced in such a manner as to conflict with or be contrary to the federal statutes prescribing a labor preference to honorable discharged soldiers, sailors, or marines, prohibiting as unlawful any other preference or discrimination among citizens of the United States."

13.2 Successors and Assigns

In subparagraph 13.2.1, in the second sentence, delete “Except as provided in Subparagraph 13.2.2,”.

Delete subparagraph 13.2.2.

13.5 Interest.

Delete paragraph 13.5 and substitute the following:

13.6 Payments due and unpaid under the Contract Documents (21 days from date received by the Owner) shall bear no interest until 30 days past due, thereafter they shall bear interest at the rate of 8% per annum until the date of the check as posted by the owner.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 Termination by the Contractor

In subparagraph 14.1.1, in the first sentence, delete the number "30" and substitute the number "60".

Delete subparagraphs 14.1.1.3 and 14.1.1.4.

Delete subparagraph 14.1.2.
In subparagraph 14.1.3 delete “or 14.1.2”.

Delete subparagraph 14.1.4.

14.2 Termination by the Owner for Cause

In subparagraph 14.2.2.3 delete the last sentence.

14.4 Termination by the Owner for Convenience

Delete subparagraph 14.4.3 and substitute the following:
14.4.3 In the case of such termination for the Owner convenience, the Contractor shall be entitled to receive payment from the Owner on the same basis provided in Subparagraph 14.1.3, as modified.

ARTICLE 15 CLAIMS AND DISPUTES

15.1 Claims

Delete subparagraph 15.1.2 and substitute the following:

15.1.2 Notice of Claims. A Claim by either party must be made by written notice to the Architect within ten (10) days from the date of the occurrence of the event or discovery of the condition giving rise to the Claim or within ten (10) days from the date that the Claimant knew or should have known of the event or condition. Unless the Claim is made within the aforementioned time requirements, it shall be deemed to be waived. The written notice of Claim shall include a factual statement of the basis for the Claim, pertinent dates, contract provisions offered in support of the Claim, additional materials offered in support of the Claim and the nature of the resolution sought by the Claimant. The Architect will not consider, and the Owner shall not be responsible or liable for, any Claims from subcontractors, suppliers, manufacturers, or other persons or entities not a party to this Contract. Once a Claim is made, the Claimant shall cooperate with the Architect and the party against whom the Claim is made in order to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition.

Add to 15.1 the following:

15.1.8 Concealed or Unknown Conditions. If conditions are encountered at the site which are subsurface or are otherwise concealed or unknown physical conditions which differ materially from those indicated in the Contract Documents or which were not reasonably susceptible of being disclosed by the Contractor's examination of the site in accordance with Subparagraph 15.1.7.1 of these Supplementary Conditions, then notice by the observing party shall promptly be given to the Architect and the other party before the conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially from the Contract Documents or if they were not reasonably susceptible of being disclosed by the Contractor's examination of the site, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both, if the conditions cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Contract. If the Architect determines that the conditions at the site do not warrant an adjustment in the Contract terms, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. If the Owner and the Contractor cannot agree on an equitable adjustment to the Contract terms or otherwise disagree with the determination of the Architect, the matter shall be subject to further proceedings in accordance with Paragraph 15.2

Add to 15.1. the following:

15.1.9 The Contractor agrees and acknowledges that he has had sufficient time and opportunity to examine the Contract Documents and the site of the work in order to undertake any necessary actions to determine the character of the subsurface materials and site conditions to be encountered. No adjustment in the Contract Time or Contract Sum shall be permitted in connection with a subsurface, concealed or unknown site condition which does not differ in any material respect from those conditions disclosed or which reasonably should have been disclosed or identified by the Contractor's examination of the Contract Documents and the site of the work.

Add to 15.1 the following:

15.1.10 The Contractor shall not be entitled to an adjustment in Contract Time or in Contract Sum for any delay or failure of performance to the extent such delay or failure was caused by the Contractor or anyone for whose acts the Contractor is responsible. The Contractor shall be entitled to an equitable adjustment in Contract Time, and may be entitled to an equitable adjustment in Contract Sum, if the cost or time of Contractor's performance is delayed or changed due to the fault of the Owner. To the extent any delay or failure of performance was concurrently caused by the Owner and Contractor, the Contractor shall be entitled to an adjustment in the Contract Time for that portion of the delay or failure of performance that was

concurrently caused, but shall not be entitled to an adjustment in Contract Sum. In the event that the Contractor is entitled to an adjustment in Contract Sum, the Owner will pay only for the following verifiable costs directly associated with the time extension or delay: 1) the actual labor costs, fringe benefits, employment taxes and insurance related to the Project Superintendent; 2) the cost associated with the fair rental value of the Project Superintendent's vehicle directly related to the time extension; 3) the direct costs attributable to the extension for the field office facility, including telephone lines, utilities, power, lights, water, and sewer (toilets). Mark-up on these costs will not be allowed. The Contractor shall make all reasonable efforts to prevent and mitigate the effects of any delay regardless of cause.

Add to 15.1 the following:

15.1.11 All Claims for costs related to Claims for additional time shall be pursuant to Paragraph 15.1.4. The Contractor shall not be entitled to make a Claim for adjustment in the Contract Sum based upon the matter of adverse weather conditions or force majeure.

15.3 Mediation

In subparagraph 15.3.2 delete the last two sentences.

15.4 Arbitration

Delete entirely all subparagraphs in 15.4 and substitute the following:

15.4.1 The Contractor and the Owner shall not be obligated to resolve any Claim or dispute related to this Contract by arbitration. Upon agreement of the parties and following the exhaustion of mediation, any Claim related to this Contract may be submitted to arbitration, either binding or non-binding, upon mutually agreeable terms and conditions. In the absence of such agreement, any reference in this Contract to arbitration is deemed void and has no force or effect.

END OF SUPPLEMENTARY CONDITIONS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Multiple Work Packages.
5. Contractor's use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.
9. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.3 PROJECT INFORMATION

A. Project Identification: Career Technical Building Tenant Improvement

1. Project Location: 915 S Main Street, Payette, ID 83661.

B. Owner: Payette School District #371, 1312 1st Avenue N, Payette, ID 83661.

1. Owner's Representative: Alvin Hall, Superintendent, 208-226-5173.

C. Architect: Hutchison Smith Architects, 270 N 27th Street, Suite 200, Boise, ID 83702.

1. Architect's Representative: Glenn Robinette, 208-338-1212.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Mechanical , Electrical, Plumbing Engineer: Nielson Engineering.

a. Mechanical & Plumbing Representative: Gordon Nielson, 208-232-2577.
b. Electrical Representative: Mike Inskeep, 208-232-2577

2. Structural Engineer: Ally Structural Consulting, LLC.

a. Structural Representative: Craig Brasher, 208-949-5993.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. 16,408 s.f. Existing building that was originally built as a car dealership and dealership repair building. To be converted into a High School Career Technical Education Building.
2. The tenant improvement will consist new electrical service upgrade, new toilet facilities, new classrooms, new mechanical systems and modifications to the existing fire sprinkler system to accommodate the new floor plans and occupancy
3. The project is projected to be built in phases as indicated on the drawings.

B. Type of Contract:

1. Project will be constructed under coordinated, concurrent multiple contracts. See bid packages for complete descriptions of work.

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Each Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of the Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways 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 for storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

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

1.7 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 6:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: TBD.
2. Hours for Utility Shutdowns: Provide 72 hours’ notice to Owner.
3. Hours for Core Drilling: Coordinate with Owner.

C. 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 for temporary utility services according to requirements indicated:

1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
2. Obtain Construction Manager's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.
2. Obtain Construction Manager's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug, and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

1. Base Bid: Portion A as indicated on the drawings along with all associated items.

2. Alternate #1: Portion B as indicated on the drawings along with all associated items.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

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

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided in Project Manual, acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 7 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
    b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

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

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

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

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect, or Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction

Manager.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use for provided by Construction Manager.

1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's Project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

a. Related Specification Section or division.
b. Description of the Work.
c. Name of subcontractor.
d. Change Orders (numbers) that affect value.
e. Dollar value of the following, as a percentage of the Contract Sum to nearest one-

hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

1) Labor.
2) Materials.
3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site.

5. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
6. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and Construction Manager and paid for by Owner.

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

C. Application for Payment Forms: Use application provided by Construction Services, Inc. as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor may be acceptable to Construction Manager and Owner. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect, and/or Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last

day of construction period covered by application.

4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

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

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

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit 1 signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

H. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706.

5. AIA Document G706A.
6. AIA Document G707.
7. Evidence that claims have been settled.
8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

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

1.2 DEFINITIONS

A. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities, list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate

construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination of Multiple Contracts: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 REQUEST FOR INFORMATION (RFI)

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

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

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

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

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

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

1. The following Contractor-generated RFIs will be returned without action:

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

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

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

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

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's and Construction Manager's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

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

1.6 PROJECT MEETINGS

A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

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

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.

e. Designation of key personnel and their duties.
f. Lines of communications.
g. Use of web-based Project software.
h. Procedures for processing field decisions and Change Orders.
i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Preparation of Record Documents.
o. Use of the premises and existing building.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Construction waste management and recycling.
w. Parking availability.
x. Office, work, and storage areas.
y. Equipment deliveries and priorities.
z. aa. First aid.
aa. Security.
bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager, , and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.

l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.

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

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Procedures for completing and archiving web-based Project software site data files.
d. Submittal of written warranties.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.

n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Construction Manager will conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site use.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of Proposal Requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress

meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Construction Manager will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site use.
        9) Temporary facilities and controls.
        10) Work hours.
        11) Hazards and risks.
        12) Progress cleaning.
        13) Quality and work standards.
        14) Status of RFIs.
        15) Proposal Requests.
        16) Change Orders.
        17) Pending changes.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
2. Section 014000 "Quality Requirements" for schedule of tests and inspections.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

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

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

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

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

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

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

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports to contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at monthly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.4 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including work stages interim milestones and partial Owner occupancy.
4. Review submittal requirements and procedures.
5. Review time required for review of submittals and resubmittals.
6. Review requirements for tests and inspections by independent testing and inspecting agencies.
7. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
8. Review and finalize list of construction activities to be included in schedule.
9. Review procedures for updating schedule.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

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

B. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

    a. Securing of approvals and permits required for performance of the Work.
    b. Temporary facilities.
    c. Construction of mock-ups, prototypes and samples.
    d. Owner interfaces and furnishing of items.
    e. Interfaces with Separate Contracts.
    f. Regulatory agency approvals.
    g. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

    a. .

4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.

1. Work under More Than One Contract: Include a separate activity for each contract.
2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Seasonal variations.
    e. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.

d. Fabrication.
e. Sample testing.
f. Deliveries.
g. Installation.
h. Tests and inspections.
i. Adjusting.
j. Curing.
k. Building flush-out.
l. Startup and placement into final use and operation.
m. Commissioning.

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

a. Structural completion.
b. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

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

1. Temporary enclosure and space conditioning.

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

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

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

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate Final Completion percentage for each activity.

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

I. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.8 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.

17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List to be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

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

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

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect

and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

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

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.

16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect via Construction Manager by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

    a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Paper: Prepare submittals in paper form and deliver to Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's, &Construction Manager's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect, & Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

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

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

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

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

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

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

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.

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

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

2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 x 36 inches.

    a. Three opaque copies of each submittal. Architect and Construction Manager will retain two copies; remainder will be returned.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

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

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

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

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be

signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.

2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

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

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file, three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

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

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp, indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action.

a. No Exceptions Taken
b. Make Correction Noted
c. Rejected
d. Revise and Resubmit
e. Submit Specified Item

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and

Construction Manager will forward each submittal to appropriate party.

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

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect and Construction Manager will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Related Requirements:

1.2 DEFINITIONS

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

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

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

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

F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.3 DELEGATED DESIGN SERVICES

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

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

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

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

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

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

1. Seismic-force-resisting system, designated seismic system, or component listed in the

Statement of Special Inspections.

2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

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

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

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

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.6 REPORTS AND DOCUMENTS

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

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

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

Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

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

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

1.7 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

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

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor's Responsibilities:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
e. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, through Construction Manager, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "Allowances," as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

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

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority, , Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

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

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's and authorities' having jurisdiction reference during normal working hours.

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

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

E. Erosion and Sedimentation Control Plan: Show compliance with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

F. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

G. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

3. Indicate methods to be used to avoid trapping water in finished work.

H. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste-handling procedures.
5. Other dust-control measures.

I. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:

1. Methods used to meet the goals and requirements of Owner.
2. Concrete cutting method(s) to be used.
3. Location of construction devices on the site.
4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with Owner.
6. Indicate locations of sensitive areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.3 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

1.4 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

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

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

C. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

D. Electric Power Service:

1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

a. Connect temporary service to Owner's existing power source, as directed by Owner.

E. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Utilize designated area within existing building for temporary field offices.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Storage and Staging: Use designated areas of Project site for storage and staging needs.

C. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs, so they are legible at all times.

D. Waste Disposal Facilities:

1. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
2. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control:

1. Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent, and requirements specified in Section 311000 "Site Clearing."
2. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, in accordance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

    a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
    b. Inspect, repair, and maintain erosion- and sedimentation-control measures during

construction until permanent vegetation has been established.

c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.

d. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are

subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated

results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 015723 - TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary stormwater pollution controls.

1.2 INFORMATIONAL SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPP): Within 15 days of date established for commencement of the Work, submit completed SWPPP.

B. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."

C. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.

D. Inspection reports.

1.3 QUALITY ASSURANCE

A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.

1. SWPPP Coordinator shall complete and finalize the SWPPP form.
2. SWPPP Coordinator shall be responsible for inspections and maintenance of all requirements of the SWPPP.

B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.

B. Locate stormwater pollution controls in accordance with the SWPPP.

C. Conduct construction as required to comply with the SWPPP and that minimize possible

contamination or pollution or other undesirable effects.

1. Inspect, repair, and maintain SWPPP controls during construction.

    a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.

D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 015723

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 017700 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating

comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:

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

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.

b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS
PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering.
3. Installation.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for coordination of, and limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

a. Contractor's superintendent.
b. Trade supervisor responsible for cutting operations.
c. Trade supervisor(s) responsible for patching of each type of substrate.
d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Layout Conference: Conduct conference at Project site.

1. Prior to establishing layout of new and existing perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

a. Contractor's superintendent.
b. Contractor's personnel responsible for performing Project surveying and layout.
c. Professional surveyor responsible for performing site survey serving as basis for Project design.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certified Surveys: Submit two copies signed by land surveyor.

C. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.

D. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time

permanent services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Plumbing piping systems.
f. Mechanical systems piping and ducts.
g. Control systems.
h. Communication systems.
i. Fire-detection and -alarm systems.
j. Electrical wiring systems.
k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Equipment supports.
d. Piping, ductwork, vessels, and equipment.
e. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through Construction Manager in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and

levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.

a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period.

Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.

5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate

visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect and Construction Manager.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. PDF Electronic File: Architect, through Construction Manager, will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect.

E. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
l. Remove labels that are not permanent.
m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with Section 230130.52 "Existing

HVAC Air-Distribution System Cleaning." Provide written report on completion of cleaning.

q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
r. Clean strainers.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
2. Submit three paper copies. Architect, through Construction Manager, will return two copies.

C. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and

maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include a comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for

notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care

and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordinating Project Record Documents covering the Work of multiple contracts.
2. Section 017300 "Execution" for final property survey.
3. Section 017700 "Closeout Procedures" for general closeout procedures.
4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
3) Submit Record Digital Data Files and one set(s) of plots.
4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit one paper-copy set(s) of marked-up record prints.
2) Submit Record Digital Data Files and three set(s) of Record Digital Data File plots.
3) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect and Construction Manager.
    e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation

varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.4 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification

Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.

l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.5 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.6 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected site elements.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. TBD

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials:

1. It is not expected that hazardous materials will be encountered in the Work.

a. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.6 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition

operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent

injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal

operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each.

1. Portland cement.
2. Aggregates.
3. Admixtures.
4. Vapor retarders.
5. Curing materials.
6. Joint fillers.
7. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Maximum w/cm.
4. Slump limit.
5. Air content.
6. Nominal maximum aggregate size.
7. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Reinforcing layout.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician .

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Field Quality-Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.7 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded.

Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: ¾” inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.4 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Stego Industries, LLC

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

C. Water: Potable or complying with ASTM C1602/C1602M.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber,ASTM D1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80, aromatic polyurea with a Type A shore durometer hardness

range of 90 to 95 in accordance with ASTM D2240.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

2.8 CONCRETE MIXTURES

A. Footings: Proportion normal-weight concrete mixture indicated on structural drawing notes.

B. Foundation Walls: Proportion normal-weight concrete mixture indicated on structural drawing notes

C. Slabs-on-Grade: Proportion normal-weight concrete mixture indicated on structural drawings.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and

reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap joints 6 inches and seal with manufacturer's recommended tape.
4. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
5. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
6. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of

concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by EOR in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/4 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class B.
    e. Locations: Apply to concrete surfaces exposed to public view,, to receive a rubbed finish,, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:

    a. Perform no later than one day after form removal.
    b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
    c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
        2) Specified overall values of flatness, FF 35; and of levelness, FL 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.
        3) Specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.
        4) Specified overall values of flatness, FF 50; and of levelness, FL 25; with minimum local values of flatness, FF 40; and of levelness, FL 17.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12 inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

d. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by

power spray or roller in accordance with manufacturer's written instructions.

2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

   a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
   b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

   a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
   b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
   c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
   d. Place, compact, and finish to blend with adjacent finished concrete.
   e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.

3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

6. Compression Test Specimens: ASTM C31/C31M:

    a. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
    c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi .
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of

concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.16 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Pre-faced concrete masonry units.
4. Steel reinforcing bars.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of product. For masonry units, include data on material properties.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

B. Mock-Up to be incorporated into work

1.6 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Insulated CMUs: Where indicated, units shall contain rigid, specially shaped, molded-polystyrene insulation units complying with ASTM C578, Type I, designed for installing in cores of masonry units.

1. Basis of Design: Basalite
   a. Korfil Hi-R H

C. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi
2. Density Classification: Medium weight

2.3 CONCRETE LINTELS

A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C144.

1. White-Mortar Aggregates: Natural white sand or crushed white stone.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C404. 3/8” maximum.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

H. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.7 MASONRY-CELL FILL

A. Loose-Fill Insulation: Perlite complying with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime or masonry cement mortar.
4. For reinforced masonry, use portland cement-lime or masonry cement mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mmas measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: match existing building scoring

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

E. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 48 inches.

3.6 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.7 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.8 MASONRY WASTE DISPOSAL

A. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior non-load-bearing wall framing.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Interior non-load-bearing wall framing.
3. Vertical deflection clips.
4. Power-actuated anchors.

1.3 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association, or, the Supreme Steel Framing System Association.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 COLD-FORMED METAL FRAMING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Clark Dietrich

2. Craco Manufacturing, Inc.
3. SCAFCO Steel Stud Company; Stone Group of Companies

2.2 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-1/4 inches.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.4 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or, ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.

2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor, or, adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

2.6 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Structural Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for

which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows: top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches,As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking, cants, and Nailers.
5. Wood furring and grounds].
6. Wood sleepers.
7. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency..

E. Application: Treat all rough carpentry unless otherwise indicated.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
1. Species:

a. Hem-fir (north); NLGA.
b. Southern pine; SPIB.
c. Douglas fir-larch; WCLIB or WWPA.
d. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

B. Framing Other Than Non-Load-Bearing Partitions: Any species and grade with a modulus of elasticity of at least 1,500,000 psi width for single-member use.

C. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type.

2.5 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Boise Cascade Millwork or Approved equivalent
2. Extreme Fiber Stress in Bending, Edgewise: 3100 psi depth members.
3. Modulus of Elasticity, Edgewise: 2,000,000 psi

B. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D5055.

1. Boise Cascade Millwork or Approved equivalent
2. Web Material: Either OSB or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
3. Structural Properties: Depths and design values not less than those indicated.
4. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA-EWS standard.

C. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.

1. Manufacturer: Provide products by same manufacturer as I-joists.
2. Material: [All-veneer product] [glued-laminated wood] [or] [product made from any combination solid lumber, wood strands, and veneers].
3. Thickness: [1 inch (25 mm)] [1-1/8 inches (28 mm)] [1-1/4 inches (32 mm)].

Referencing APA-EWS standard may reduce competition by eliminating manufacturers that do not participate in APA-EWS program. See the Evaluations.

4. Comply with APA PRR-401, [rim board] [rim board plus] grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

Usually retain all options in "Rim Board Material" Subparagraph below.

5. Rim Board Material: [All-veneer product] [glued-laminated wood] [or] [product made from any combination solid lumber, wood strands, and veneers].
6. Rim Board Thickness: [1 inch (25 mm)] [1-1/8 inches (28 mm)] [1-1/4 inches (32 mm)].
7. Insulation: 1-1/2-inch- (38-mm-) thick polyisocyanurate foam complying with ASTM C1289.
8. Inside Facing: 7/16-inch- (11-mm-) thick OSB.

Referencing APA-EWS standard may reduce competition by eliminating manufacturers that do not participate in APA-EWS program. See the Evaluations.

9. Comply with APA PRR-401, [rim board] [rim board plus] grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

2.6 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. Dimension Lumber Items: Construction or No. 2.

C. Concealed Boards: 15 any of the following species and grades:
   1. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.7 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C nominal thickness.

2.8 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on [ICC-ES AC01] [ICC-ES AC58] [ICC-ES AC193] [or] [ICC-ES AC308] as appropriate for the substrate.

2.9 METAL FRAMING ANCHORS

A. Simpson Strong-Ties or approved equivalent

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated] [of basis-of-design products of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

   1. Use for interior locations unless otherwise indicated.

D. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, [butyl rubber] [or] [rubberized-asphalt] compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

E. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate [furring,]nailers, blocking, [grounds,]and similar supports to comply with requirements for attaching other construction.

D. Install shear wall panels to comply with manufacturer's written instructions.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet [wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.

B. Related Requirements:

1. Section 074113 "Metal Wall Panels"
2. Section 072100 “Thermal Insulation”

1.3 ACTION SUBMITTALS

A. Product Data:

1. Wall sheathing as indicated on plans.
2. Roof sheathing as indicated on plans.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise specified.

C. Oriented Strand Board: DOC PS 2.

D. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

E. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

A. Oriented-Strand-Board Sheathing, Walls: DOC PS 2, Exposure 1, Structural I sheathing.

1. Span Rating: Per General Structural Notes on Drawings.
2. Nominal Thickness: Not less than 1/2 inch.

2.3 ROOF SHEATHING

A. Oriented-Strand-Board Sheathing, Roofs: DOC PS 2, Exposure 1, Structural I sheathing.

1. Span Rating: Per General Structural Notes on drawings.
2. Nominal Thickness: Not less than 5/8 inch.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Coordinate wall, and, roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

E. Coordinate sheathing installation with installation of materials installed over sheathing so

sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

END OF SECTION 061600

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319. Panels shall be USDA accepted for incidental food contact.

1. Cameron Ashley Building Products

2. Or approved equivalent
3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E84. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

4. Nominal Thickness: Not less than [0.075 inch
5. Surface Finish: Molded pebble texture].
6. Color: As approved by owner or Architect.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

C. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches.

3.2 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive. Do not fasten through panels.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 071400 - FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solvent-based asphalt waterproofing.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.

1.3 REFERENCE STANDARDS

A. ICC-ES AC29 - Acceptance Criteria for Cold, Liquid-Applied, Below-Grade, Exterior Dampproofing and Waterproofing Materials; 2011, with Editorial Revision (2020).

B. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Solvent-Based Asphalt Waterproofing:

1. Carlisle Coatings & Waterproofing:
2. Or approved equivalent

2.2 FLUID-APPLIED WATERPROOFING MATERIALS

A. Solvent-Based Asphalt Waterproofing: Rubber, latex, or polymer modified for increased flexibility.

1. Cured Thickness: 60 mil, 0.060 inch, minimum.

2.3 ACCESSORIES

A. Surface Conditioner: Concrete, compatible with membrane compound; as recommended by membrane manufacturer.

B. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.

C. Brushed-On Coating: Cold-applied elastomeric coating that provides waterproofing, corrosion protection, and weather resistance.

1. Coverage: Apply coating between 15 to 30 sq ft/gal to produce at least 40 to 120 mil, 0.040 to 0.12 inch thick coating.
2. Products:
    a. Henry's 101 - Non Fibered Foundation Coating

    b. Or approved equivalent

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

B. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

3.3 INSTALLATION

A. Install waterproofing to specified minimum thickness in accordance with manufacturer’s instructions and NRCA (WM) applicable requirements.

B. Seal membrane and flashings to adjoining surfaces.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation - (unfaced).

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Formular NGX F-150 SSE 15-psi minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Owens Corning
b. Or approved equivalent
c. Thicknesses and location as refer to plans.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Formular NGX F-250 SSE 15-psi minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Owens Corning
b. Or approved equivalent
c. Thicknesses and location as refer to plans.

B. Location and R-vaules as indicated on plans.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Polyethylene vapor retarders.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

A. Under concrete slab vapor retarder Polyethylene Vapor Retarders: ASTM D4397, 10-mil- thick sheet, with maximum permeance rating of 0.1 perm.

1. Basis of design: W.R. Medows Perminator (10 Mil)

B. Exterior walls Polyethylene Vapor Retarders: ASTM D4397, 4-mil- thick sheet, with maximum permeance rating of 0.1 perm.

2.2 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072600

SECTION 072700 - AIR BARRIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air barriers.

1.2 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.4 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

B. Air Barrier Association of America (ABAA) Evaluated Air Barrier Assemblies; www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

D. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.5 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 - PRODUCTS

2.1 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air Barrier Sheet, Mechanically Fastened:

1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, Class A, when tested in accordance with ASTM E84.
5. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2-1/2 inches wide, compatible with sheet material; unless otherwise indicated.
6. Products:
   a. DuPont de Nemours, Inc; Tyvek CommercialWrap D with Tyvek Tape : building.dupont.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Mechanically Fastened Sheets - On Exterior:

1. Install sheets shingle fashion to shed water, with seams generally horizontal.
2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
4. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
5. Install air barrier underneath jamb flashings.
6. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

E. Openings and Penetrations in Exterior Air Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.

2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Coordination of ABAA Tests and Inspections:

1. Provide testing and inspection required by ABAA QAP.
2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed air barriers until required inspections have been completed.

D. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam metal wall panels.
2. Concealed-fastener, lap-seam metal wall panels.
3. Metal liner panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F

E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal liner panels designed for interior side walls and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for a complete installation.

Basis of Design: Berridge Manufacturing Co.

Product: HR-16

1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Nominal Thickness: 22 ga
    b. Exterior Finish: Three-coat fluoropolymer
    c. Color: As selected by Architect from manufacturer's full range

2. Panel Coverage: 16 inches
3. Seam Height: 7/8 inches
4. Fasteners: Concealed
5. Applications: Horizontal
6. Pattern: 7/8” height and 4” rib with 2” reveal

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
2. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat.
3. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
4. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.2 INSTALLATION

A. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

B. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of

metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213.13

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Mechanically fastened thermoplastic polyolefin (TPO) roofing system (main roof).
2. Adhered thermoplastic polyolefin (TPO) roofing system (lower roofs and balcony decks).
3. Roof insulation for crickets.
4. Substrate Board.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

B. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

C. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

D. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
2. Warranty Period: 30 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carlisle SynTech Incorporated.
   2. Firestone Building Products.
   3. GAF Materials Corporation.
   4. Johns Manville Incorporated.
   5. Versico Incorporated.

B. Source Limitations: Obtain components including roof insulation, fasteners, etc., for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:

   1. Corner Uplift Pressure: 55.92 psf.
   2. Perimeter Uplift Pressure: 39.23 psf.
   3. Field-of-Roof Uplift Pressure: 25.87 psf.

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.

1. Thickness: 80 mils, nominal.
2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Single-Ply Roof Membrane Adhesives: 250 g/L.
f. Single-Ply Roof Membrane Sealants: 450 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.
j. Other Adhesives and Sealants: 250 g/L.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sheet Flashing: Manufacturer's standard TPO sheet flashing, 60 mils thick, minimum, of same color as TPO sheet.

C. Bonding Adhesive: Manufacturer's standard.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer’s standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3mm) thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick.
   1. Basis of Design Product: Georgia Pacific Gypsum Corp, “Dens-Deck” over plywood substrate.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.6 INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

   1. Basis of Design: GAF Energy Guard Polyiso Insulation
   2. Size: 48 by 48 inches
   3. Thickness:

      a. Base Layer: 2.6”
      b. Upper Layer: 2.6”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

3.5 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch) of nailers, projections, and penetrations.

E. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

F. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.6 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.7 MECHANICALLY FASTENED ROOFING INSTALLATION

A. Mechanically fasten roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten or adhere roofing securely at terminations, penetrations, and perimeter of roofing.

E. Apply roofing with side laps shingled with slope of roof deck where possible.

F. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within seam, and mechanically fasten TPO sheet to roof deck.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: _____.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding 90 mph;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work

covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous sheet metal fabrications.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include details for forming, including profiles, shapes, seams, and dimensions.
2. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
3. Include details of termination points and assemblies.
4. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
5. Include details of roof-penetration flashing.
6. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.

7. Include details of special conditions.
8. Include details of connections to adjoining work.
9. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Do not use graphite pencils to mark metal surfaces.

2.3 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
5. Gutter Profile: As indicated.
6. Expansion Joints: Butt type with cover plate.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch- wide, joint cover plates. Pre-finished steel: 24 Ga.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Pre-finished Steel: 24 Ga. (Keynar 500).

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Pre-finished Steel: 24 Ga. (Keynar 500).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of welds sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

C. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Fasten gutter spacers to front and back of gutter.

C. Downspouts:

1. Provide hangers with fasteners designed to hold downspouts securely to walls.
2. Locate hangers at top and bottom and at approximately 60 inches o.c.
3. Provide elbows at base of downspout to direct water away from building.

D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.4 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Anchor as indicated: Provide shop drawings prior to fabrication.

3.5 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

3.8 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Urethane joint sealants.
2. Latex joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Urethane joint sealants.
2. Latex joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

1.4 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.5 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Sika Corporation - Building Components
b. Tremco Incorporated

2.3 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation
b. Tremco Incorporated

2.4 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

B. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Gypsum Board.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.

B. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide flush joint profile at locations indicated on Drawings in accordance with Figure 8B in ASTM C1193.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior standard steel frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.

D. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded

to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Curries, AADG, Inc.; ASSA ABLOY Group
2. Mesker Door; Mesker Openings Group
3. Steelcraft; Allegion plc
4. West Central Manufacturing, Inc.
5. Artek

2.2 INTERIOR STANDARD FRAMES

A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Frames:

a. Materials: steel sheet, minimum thickness of 0.053 inch.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Face welded.

2. Exposed Finish: Prime.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.

c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
d. Edge Construction: Model 2, SeamlessFully welded in factory.
e. Core: Manufacturer's standard.

1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than R2.0 when tested according to ASTM C 1363.

f. Glass opening: Refer to drawings.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

C. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

D. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

E. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 NAAMM-HMMA 840.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.

4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish in accordance with manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.
2. Solid-core flush wood doors with veneer faces.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain flush wood doors from single manufacturer. Subject to compliance with requirements, provide products by the following.

B. VT Industries Inc, or pre-approved equal.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Provide labels from AWI certification program indicating that doors comply with requirements of grades specified.

2.3 Solid Core Wood Door

A. Interior Doors, Paint Grade Primed MDF Solid Core Wood Door:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Truddoor
b. Assa Abloy
c. Strek-O

2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.

3. Core for Non-Fire-Rated Doors:

a. WDMA I.S. 10 structural composite lumber.

1)	Faces:	A Grade Wood Veneer Plain Sliced
2)	Wood Species:	Birch
3)	Thickness:	1 ¾”
4)	Sizes:	3’-0” x 7’-0”
5)	Optional Preps:	Exit Device Trim, Deadbolts, Lite and Louver Cutouts
6)	Core:	28-30 particle
7)	Requirements:	ANSI A208.1 and CS236-66
8)	Finish:	Clear finish
9)	Color:	As Selected By Arhcitect
10)	Undercut:	¾”
11)	Standard Preps:	86 Edge (mortise lock)

4. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.5 FINISH

A. Factory Finish

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

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

1.2 SUMMARY

A. Section Includes:

1. Access door and frame for ceiling.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames.

D. Warranty: Submit executed copy of manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Access Doors and Frames: Flush Access doors with Exposed Flanges, steel attic access hatch:

1. Description
2. Location: Ceiling.
3. Door Size: refer to drawings.
4. Uncoated steel sheet for door: 16 gage, factory finish powder coat white.
5. Frame material: Same material, thickness and finish as door.
6. Latch and Lock;

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Frame Anchors: Same material as door face.

C. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.

2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

4. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:

1. Metal for door sections.
2. Hardware.
3. Color: Manufacturers full range of color options as approved by Archtiect.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings.
2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

4. Operability under Wind Load: Design sectional doors to remain operable under design wind load, acting inward and outward.

C. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Component Importance Factor: 1.0

2.3 SECTIONAL-DOOR ASSEMBLY

A. Sectional Door: Provide steel sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Amarr; an ASSA ABLOY Group company
b. Arm-R-Lite Manufacturing Co., Inc.
c. BP - Glass Garage Doors & Entry Systems, Inc
d. C.H.I. Overhead Doors, Inc.
e. Clopay Building Products
f. Fimbel Architectural Doors
g. Haas Door; a Nofziger Company
h. Hörmann LLC
i. Martin Door Manufacturing
j. Overhead Door Corporation
k. Raynor Garage Doors
l. Rite-Hite Holding Corporation
m. Wayne Dalton; a division of Overhead Door Corporation
n. Windsor Door

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

D. U-Value: 0.130 Btu/sq. ft. x h x deg F.

E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.

1. Door-Section Thickness: 2 inches.

2. Basis of Design: Overhead Door Sectional Door – Model 420

3. Section Faces:

a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.

1) Steel Sheet Thickness: 0.022-inch nominal coated thickness.
2) Surface: Manufacturer's standard, flat,Field verify and match existing.

c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:

1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.022 inch.

4. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch nominal coated thickness and welded to door section.

5. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.

6. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.

a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile.
b. Hardware Locations: Provide reinforcement for hardware attachment.

7. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:

a. Board Insulation: Polystyrene, secured to exterior face sheet.
b. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.

F. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.

2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.

3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical

sections of track spaced 2 inches apart for door-drop safety device.

a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle attached to track and wall.
b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top, and, jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.

H. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.

I. Locking Device:

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

2. Chain Lock Keeper: Suitable for padlock.

3. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

J. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.

2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.

a. Mount counterbalance mechanism with manufacturer's standard ball-bearing

brackets at each end of torsion shaft.

b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.

3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.

4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.

5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

   a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.

9. Control Station: Surface mounted, three-position (open, close, and stop) control.

   a. Operation: Push button.
   b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
   c. Exterior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof type, NEMA ICS 6, Type 4 enclosure.

10. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.

11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

K. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

1. Factory Prime Steel Finish: Compatible with field-applied finish and in manufacturer's

standard color. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 WARRANTY

A. Special Warranty: Manufacturer or Installer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
1. Old Castle
a. Series 3000 Multiplane

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: ASCE 7

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to [/175 of clear span for spans of up to 13 feet 6 inches
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
2. When tested at **150** percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

G. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

    a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.388 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

    a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.35 as determined in accordance with NFRC 200.

3. Air Leakage:

   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

   a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.

H. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for basic protection.

2.3 ALUMINUM-FRAMED STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally improved.
2. Interior Vestibule Framing Construction: Improved Thermally improved.
3. Glazing System: Retained mechanically with gaskets on four sides
4. Glazing Plane: Center
5. Finish: Match Existing
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.5 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221

C. Structural Profiles: ASTM B308/B308M.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

1. Color: Match existing

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.

2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed recommended by manufacturer.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

END OF SECTION 084313

SECTION 085313 - VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes vinyl-framed windows.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Window: 5 years from date of Substantial Completion.
b. Glazing Units: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: LC
2. Minimum Performance Grade: **30**.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of **0.35**

2.2 VINYL WINDOWS

A. Basis of Design:

1 Jeld-Wen Manufacturing company

B. Operating Types: slider.

C. Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Finish: Integral color, white
2. Gypsum Board Returns: Provide at interior face of frame.

D. Glass:

1. Kind: Fully tempered [**where indicated on Drawings**] <**Insert requirements**>.

E. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.
   a. Kind: Fully tempered.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Pyrolytic on second surface

F. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

G. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: Designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Operated from the inside only.
3. Roller Assemblies: Low-friction design.

H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components..

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for project-out.

2.4 FABRICATION

A. Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze vinyl windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085313

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical door hardware for:

a. Swinging doors.

2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Signage
3. Toilet accessories
4. Overhead doors

C. Related Sections:

1. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
2. Division 08 Sections:

a. “Metal Doors and Frames”
b. “Flush Wood Doors”

3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.

1.02 REFERENCES

A. UL - Underwriters Laboratories

1. UL 1784 - Air Leakage Tests of Door Assemblies
2. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
2. NFPA 101 – Life Safety Code
3. NFPA 105 – Smoke and Draft Control Door Assemblies
4. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

    a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
    b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
    c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with

hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.

c. Indicate complete designations of each item required for each opening, include:
   1) Door Index: door number, heading number, and Architect's hardware set number.
   2) Quantity, type, style, function, size, and finish of each hardware item.
   3) Name and manufacturer of each item.
   4) Fastenings and other pertinent information.
   5) Location of each hardware set cross-referenced to indications on Drawings.
   6) Explanation of all abbreviations, symbols, and codes contained in schedule.
   7) Mounting locations for hardware.
   8) Door and frame sizes and materials.
   9) Degree of door swing and handing.

4. Key Schedule:

   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

   a. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Factory order acknowledgement numbers (for warranty and service)

d. Name, address, and phone number of local representative for each manufacturer.
e. Parts list for each product.
f. Final approved hardware schedule edited to reflect conditions as installed.
g. Final keying schedule
h. Copies of floor plans with keying nomenclature
i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
j. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

    a. Warehousing Facilities: In Project's vicinity.
    b. Scheduling Responsibility: Preparation of door hardware and keying schedules.
    c. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
        1) Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

    a. For door hardware: DHI certified AHC or DHC.
    b. Can provide installation and technical data to Architect and other related subcontractors.
    c. Can inspect and verify components are in working order upon completion of installation.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Ives 5BB series

2. Acceptable Manufacturers and Products:

a. Hager BB1191/1279 series
b. McKinney TA/T4A series
c. Bommer BB5000 series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

2.02 MORTISE LOCKS

A. Manufacturers and Products:

1. Acceptable Manufacturers and Products:

a. No Substitute – Owners Standard

B. Requirements:

1. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

2.03 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:

   a. No Substitute – Owners Standard

B. Requirements:

1. Cylinders: Refer to "KEYING" article, herein.
2. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
4. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
10. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
11. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.04 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. LCN 4040XP series

2. Acceptable Manufacturers and Products:

    a. No Substitute – Owners Standard

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.05 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives.

2. Acceptable Manufacturers:

    a. Elmes
    b. Burns
    c. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.06 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.

2.07 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.08 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:

a. Zero International

2. Acceptable Manufacturers:

    a. National Guard
    b. Reese
    c. Legacy
    d. Pemko

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
3. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.09 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Burns
    b. Rockwood
    c. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

PART 3 - EXECUTION

3.01 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

J. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

K. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

L. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

M. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

N. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

O. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

P. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Provide inspection of required egress door assemblies by a qualified person in accordance with NFPA 101.

    a. Schedule egress door assembly inspection within 90 days of Substantial Completion of the Project for the required openings.
    b. Submit a signed, written final report as specified in Paragraph 1.03.E.2.
    c. Correct all deficiencies and schedule a reinspection of egress door assemblies noted as deficient on the inspection report.
    d. Inspector to reinspect required egress door assemblies after repairs are made.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

Abbreviation	Name
GLY	Glynn-Johnson Corp
IVE	H.B. Ives
KAW	Kawneer Company Inc
LCN	Lcn Commercial Division
SCH	Schlage Lock Company
STA	Stanley Security Solutions
VON	Von Duprin
ZER	Zero International Inc

HW SET: 01

For use on Door #(s):
110A 111A 113

Each to have:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-98-L-06	626	VON
1	EA	SFIC PERMANENT CORE	IC7 (MATCH EXISTING KWY)	626	BES
1	EA	SFIC RIM HOUSING	80-129	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER

HW SET: 02

For use on Door #(s):
114 115

Each to have:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

HW SET: 03

For use on Door #(s):
112

Each to have:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80BD RHO	626	SCH
1	EA	SFIC PERMANENT CORE	IC7 (MATCH EXISTING KWY)	626	BES
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 04

For use on Door #(s):
110B 111C

Each to have:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 05

For use on Door #(s):
111D

Each to have:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	LD-98-L-BE-06	626	VON
1	EA	SFIC RIM HOUSING	80-129	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: R1

For use on Door #(s):
110C 111B

Each to have:

	EA	NOTE	ALL HARDWARE BY DOOR SUPPLIER/MANUFACTURER

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
3. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC

200 and based on most current non-beta version of LBL's WINDOW computer program.

4. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 3.33 mm.

B. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Desiccant: Molecular sieve or silica gel, or a blend of both.

B. Basis of Design: Vitro Solarban 60 Glass.

1. Solarban 60 (2) Soleia + Clear

a.	Visual Light Transmittance:	61
b.	Visible Light Reflectance Exterior:	11%
c.	Visible Light Reflectance Interior:	12%
d.	NFRC U-Value Winter Nighttime:	.29
e.	Solar Heat Gain:	.32

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

D. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

E. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

F. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

G. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

H. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall Framing systems.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Wall Framing systems.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

2.2 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener

penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Gypsum
    b. CertainTeed; SAINT-GOBAIN
    c. Georgia-Pacific Gypsum LLC
    d. USG Corporation
    e. National Gypsum Company
    f. Continental Building Products, LLC

2. Thickness: 5/8 inch.
3. Long Edges: Tapered

B. Mold/Moister-Resistant Gypsum Panels: ASTM D6329

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Gypsum
    b. CertainTeed; SAINT-GOBAIN
    c. Georgia-Pacific Gypsum LLC
    d. USG Corporation
    e. National Gypsum Company
    f. Continental Building Products, LLC

2. Thickness: 5/8 inch.
3. Long Edges: Tapered
4. As noted on room finish schedule

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.6 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses

of panels.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Walls - Match existing level of FINISH.

3.5 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Armstrong World Industries, Inc., Cortega, #769

B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E 1264.

C. Color: White.

D. Modular Size: 24 by 48 inches.

2.3 METAL SUSPENSION SYSTEM

A. 15/16” Prelude XL; Armstrong World Industries, Inc.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners. Match Existing throughout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Do not use exposed fasteners, including pop rivets, on moldings and trim.
2. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flexco Corporation
2. Johnsonite; a Tarkett company
3. Roppe Corporation; Roppe Holding Company

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style B, Cove: Where indicated on schedule.

C. Thickness: 0.125 inch.

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: Black.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less and 60 g/L or less for rubber stair treads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter corners to minimize open joints.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient vinyl flooring
2. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and pattern specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 Resilient vinyl Flooring (FF-1)

A. Basis of Design
1. Manufacturer: Armarco
2. Protect-All Flooring
3. Or approved equivalent

B. Tile Standard: ASTM F1700.

C. Colors and Patterns: To be selected by owner or architect

D. Size: 2’ x 2’ x ¼” thickness

E. Base Size: 4”
   1. Protect-All V-Rod

2.3 Vinyl Composite Tile (FF-2)

A. Basis of Design:
   1. Manufacturer: Armstrong Flooring
   2. Style: Standard Excelon Imperial Texture
   3. Or Approved Equivalent

B. Tile Standard: ASTM F1066, Class 2, through pattern

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch

E. Size: 12 by 12 inches

F. Colors and Patterns: As selected by owner or architect

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Refer to manufactures requirements

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowel able leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes selected.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. As recommended by Manufacturer.

END OF SECTION 096519

SECTION 099114 - EXTERIOR PAINTING (MPI STANDARDS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface preparation and application of paint systems on the following exterior substrates:

a. Primed Insulated Metal Doors.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
3. Indicate VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: percent, but not less than 5 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Co.
2. PPG Paints; PPG Industries, Inc.
3. Rodda Paint Co.
4. Valspar; a brand of The Sherwin-Williams Company
5. Sherwin-Williams Company (The)

B. MPI Standards: Provide products complying with MPI standards indicated and listed in its "MPI Approved Products List."

C. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

D. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Nonflat Paints and Coatings: 50 g/L.
2. Primers, Sealers, and Undercoaters: 100 g/L.
3. Rust-Preventive Coatings: 100 g/L.

E. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings

and acceptable to intermediate and topcoat paint manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates:

1. Alkyd System MPI EXT 5.1D

a. Alkyd Prime Coat: Primer, alkyd, anticorrosive, for metal.

1) Procryl S/G SW-B66W01310.

b. Intermediate Coat: High performance Architectural latex. DTM Acrylic Semi-Gloss B66W211.

c. Semigloss Topcoat: Alkyd, exterior, semigloss (MPI Gloss Level 5).

1) High-performance Architectural latex. DTM Acrylic Semi-Gloss B66W211..

END OF SECTION 099114

SECTION 099124 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel and iron.
2. Gypsum board.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: percent, but not less than 5 gal of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Benjamin Moore & Co.
2. Rodda Paint Co.
3. Valspar; a brand of The Sherwin-Williams Company
4. Sherwin-Williams Company (The)

B. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

C. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

D. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2.
2. SSPC-SP 3.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name,

identification, performance rating, or nomenclature plates.

5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Latex System, Alkyd Primer, MPI INT 5.1Q

a. Prime Coat:
b. Shop primer specified in Section where substrate is specified.

c. Intermediate Coat: Latex, interior, matching topcoat.
d. Topcoat:

1) Latex, interior (MPI Gloss Level 4), MPI #43.

a) Sherwin Williams.

B. Gypsum Board and Plaster Substrates:

1. High-Performance Architectural Latex System, MPI INT 9.2B:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

1) Sherwin Williams: Drywall Primer B28W8150.

b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
c. Topcoat:

1) Latex, interior, high performance architectural (MPI Gloss Level 4), MPI #140.

a) Sherwin Williams

C. CMU Substrates:

1. Latex System, MPI INT 4.2A

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

1) Sherwin Willams

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semigloss (MPI Gloss Level 5, MPI #54.

1) Sherwin Williams

END OF SECTION 099124

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Panel signs. Interior.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least full size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample.

E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in ICC A117.1.

2.2 PANEL SIGNS

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ACE Sign Systems, Inc.
b. Advance Corporation
c. Allen Industries
d. Allen Markings
e. APCO Graphics, Inc
f. ASE, Inc
g. ASI Sign Systems, Inc
h. Best Sign Systems, Inc.
i. Bunting Graphics, Inc

j. Clarke Systems
k. Cosco
l. Diskey Sign Company
m. Fossil Industries, Inc.
n. inpro Corporation
o. Mohawk Sign Systems
p. Nelson-Harkins Industries
q. Poblocki Sign Company, LLC
r. Seton Identification Products; a Brady Corporation company
s. Signs & Decal Corp
t. Vista System, LLC
u. Vomar Products, Inc

2. Solid-Sheet Sign: Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:

a. Thickness: As indicated on Drawings, 0.125 inch.
b. Surface-Applied, Flat Graphics: Applied baked enamel or powder coat, or paint.
c. Surface-Applied, Raised Graphics: Applied polymer characters, and, Braille.

3. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition:

1) Vertical Edges: As indicated on Drawings.

b. Corner Condition in Elevation: As indicated on Drawings.

4. Mounting: Manufacturer's standard method for substrates indicated with two-face tape.
5. Surface Finish and Applied Graphics:

a. Integral Sheet Color: Acrylic sheet with color as selected by Architect from full range of industry colors.

6. Text and Typeface: Accessible raised characters and Braille,typeface as selected by Architect from manufacturer's full range. Finish raised characters to contrast with background color, and finish Braille to match background color.
7. Flatness Tolerance: Sign is to remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

2.3 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

B. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessible Signage: Install in locations on walls as indicated on Drawings, and, according to the accessibility standard.

C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign and two-face tape.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Underlavatory guards.
3. Custodial accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser: (Owner Supplied, Contractor installed)

B. Paper Towel (Folded) Dispenser: (Owner Supplied, Contractor installed)

C. Soap Dispenser: (Owner Supplied, Contractor Installed)

D. Surface Mounted Toilet Seat Cover Dispenser: Basis of design Brandley 583 Stainless Steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AJW Architectural Products
b. ASI-American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc
d. Bradley Corporation
e. Brey-Krause Manufacturing Co.
f. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.
g. Tubular Specialties Manufacturing, Inc.

E. Grab Bar: Contractor Supplied and installed.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AJW Architectural Products
b. ASI-American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc
d. Bradley Corporation
e. Brey-Krause Manufacturing Co.
f. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.
g. Tubular Specialties Manufacturing, Inc.

2. Mounting: Flanges with concealed fasteners.

3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. OD: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit: (Owner Supplied, Owner Installed)

G. Mirror Unit: (Basis of design: Bobrick B-165)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AJW Architectural Products
    b. ASI-American Specialties, Inc.
    c. Bobrick Washroom Equipment, Inc
    d. Bradley Corporation
    e. Brey-Krause Manufacturing Co.
    f. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.
    g. Tubular Specialties Manufacturing, Inc.

2. Frame: Stainless steel angle, 0.05 inch thick, Stainless steel channel.

    a. Corners: Manufacturer's standard.

3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

2.2 UNDERLAVATORY GUARDS

A. Underlavatory Guard: (Contractor Supplied and Installed)

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Buckaroos, Inc.
    b. Plumberex Specialty Products, Inc.
    c. Truebro; IPS Corporation

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.3 CORNER GUARDS

1. Manufacturers: Subject to compliance with requirements, available manufacturers

offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Basis of Design: Inpro 130BN BluNose High Impact Corner Guard
b. Color: Antique White

2.4 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of galvanized steel where concealed.

C. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

D. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.3 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
b. Larsen's Manufacturing Company

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.

3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. B. Multipurpose Dry-Chemical Type in Steel Container refer to plans for location,: UL-rated 2-A:10-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Welded corridor lockers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Shop Drawings: For metal lockers.

   1. Include plans, elevations, sections, and attachment details.
   2. Include locker identification system and numbering sequence.

D. Samples: For each color specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

   1. Warranty Period for Knocked-Down Metal Lockers: 2 years from date of Substantial Completion.
   2. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1

2.2 CORRIDOR LOCKER

A. Basis of Design:
   1. Schoolockers.com
   2. Or Approved Equivalent

B. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

   1. Doors less than 12 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
   2. Doors for box lockers less than 15 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
   3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
   4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
   5. Door Style: Non-Vented

   6. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
   7. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
   8. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.

C. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

D. Hinges:
   1. Continuous Hinges: Manufacturer's standard, steel, full height.

.

   2. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.

E. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.

1. Single-Point Latching: Nonmoving latch hook designed to engage bolt of built-in combination with steel padlock loop that projects through recessed cup and is finished to match metal locker body.

a. Latch Hook: Equip each door with one latch hook.

F. Door Handle and Latch for Box Lockers: Stainless steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.

G. Locks: As required by Payette School District

H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped **aluminum**, with numbers and letters at least 3/8 inch high.

I. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.

J. Coat Rods: Manufacturer's standard.

K. Legs: 6 inches high; formed by extending vertical frame members nominal-thickness steel sheet; welded to bottom of locker.

1. Provide closed front and end bases

L. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.

M. Filler Panels: Fabricated from 0.036-inch nominal-thickness steel sheet.

N. Boxed End Panels: Fabricated from 0.060-inch nominal-thickness steel sheet.

O. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet..

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

P. Finish: Baked enamel or powder coat.

1. Color: As selected by owner or architect

2.3 LOCKS

A. Built-in Combination Lock: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.

1. Bolt Operation: automatically.

B. As required by Payette School District

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach boxed end panels using concealed fasteners to conceal exposed ends of non recessed metal lockers.

END OF SECTION 105113

SECTION 210501 - COMMON WATER-BASED FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Related Sections: Refer to "Electrical Division 26 for Plumbing Division 22 for HVAC Division 23 for basic plumbing, HVAC and electrical requirements, for all equipment in Division 21 and Division 23. Special and specific electrical requirements are specified within each respective equipment specification section.

1.2 SCOPE OF WORK - GENERAL

A. This section specifies the basic requirements for a complete and operable Fire Suppression System (F.S.) installations and includes requirements common to Division 21. It expands and supplements the requirements specified in sections of Division 01 General Requirements.

B. The work covered by the Fire Suppression (F.S) Sections of the Specifications shall include the furnishing of all materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of all F.S. work required in the Contract Drawings.

C. It is the intent of the Contract Documents to provide a F.S. installation that is complete and operable in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, it shall be the responsibility of the Contractor to provide all material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

D. The Contractor shall review all Contract Drawings (Plumbing, HVAC and Electrical) and Specifications and include in his bid all work specifically, as being performed in the F.S. section. The Contractor shall be responsible for all work performed any and all his subcontractors.

1.3 DEFINITIONS

A. "Provide" shall mean "furnish and install complete and ready for intended use."

B. "Indicated" shall mean "indicated on drawings" and/or the intent for a complete and operable system.

C. "Concealed" shall mean "hidden from sight as in trenches, chases, furred spaces above hung ceilings.

D. "Exposed" shall mean "not concealed", as defined above.

E. "Noted" shall mean "noted on drawings or in specifications".

F. "Contractor" also referred to as "This Contractor" or "The Contractor", shall mean "the F.S. Contractor".

1.4 CODES AND STANDARDS

A. All F.S. piping and associated work shall be installed in strict accordance with the most current edition of the International Building Code (IBC), International Mechanical Code (IMC), Uniform Plumbing Code (UPC), National Fire Protection Association (NFPA), International Fire Code (IFC), National Electrical Code (NEC), Energy Code IECC and ASHRAE-90.1, and all applicable state and local codes, laws and ordinances that relate to the work to be accomplished.

1.5 PERMITS AND FEES

A. The Contractor shall obtain and pay for all required permits and fees necessary to fully complete all work included in the Contract Drawings and Specifications.

1.6 CONSTRUCTION OBSERVATIONS:

A. During the course of construction of this project, the engineer shall visit the project site periodically on an as-needed basis. The construction observation intervals may vary depending on the progress and/or stage of construction of the other trades, whether it is being placed below grade and/or concealed, surface mounted items, setting of equipment, equipment connections, etc. However, written field questions are encouraged and welcomed throughout the course of construction and shall be answered promptly in writing, to keep the project construction on schedule. The project foreman should have the building plans, construction schedules, etc., affixed in mind, so the fire sprinkler systems defined in the construction documents are to be assembled, along with the setting of equipment, of parts and pieces, related to the project are anticipated, to prevent delays or emergencies.

B. The engineer shall make one (1) final inspection on the F.S. System. The contractor shall notify the engineer that the installation is complete, i.e., the systems are operating and have been tested and balanced, and everything is complete and operational, all equipment connections have been made and the owner's representatives have been trained. At this time the engineer, the contractor, and the owner's representative shall schedule a time to walk the project for evaluation, and record in writing the items found to be incomplete. The contractor shall make the corrections within one (1) week after this inspection. If at the conclusion of the observation tour the owner and engineer determine that additional visits are required to complete the project.

C. On extra visits, the contractor shall report to the engineer that all systems are complete, and the project is ready for the owner's acceptance.

1.7 CONSTRUCTION FUNDS

Enter amount of base bid, remove underline.

A. The contractor shall include in the base bid a fire sprinkler allowance of $_____. These funds are to be used at the discretion of the design engineer for various and asunder conditions that may arise in the course of construction. If these monies are not used, they shall be credited to the base bid when the contract closes.

1.8 INTENT AND INTERPRETATION

A. The Drawings and Specifications are intended to supplement each other, and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. The drawings are partly diagrammatic and do not necessarily show the exact location of all new piping and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic and do not necessarily show the physical arrangement of the equipment of other trades. They shall not be used for obtaining quantities or lineal runs of piping.

D. The location of all piping shall be checked to determine that it clears all openings, equipment, structural members, etc. that the system may be properly concealed; and that it clears cabinets, lights and equipment in their fixed locations.

E. The Plumbing or Architectural drawings may serve as the working drawings for this portion of the work, but the Contractor shall refer to the Architectural, Structural, HVAC, and Electrical drawings for additional detail affecting the installation of his work. Architectural drawings shall take precedence over the fire sprinkler drawings if any dimensional discrepancies exist.

F. The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the approval of the Architect, who reserves the right to make any reasonable changes in the locations indicated without additional cost.

G. The contractor shall not make a change in a system, system layout, and/or equipment, except he receives written approval or drawing over the signature of the engineer.

1.9 SUBMITTAL OF CERTIFIED PIPING LAYOUTS AND EQUIPMENT FOR APPROVAL

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 General Requirements for submittal definitions, requirements, and procedures.

B. SHOP DRAWINGS SHALL BE CERTIFIED AND CALCULATED LAYOUTS OF THE PLANNED SYSTEMS AND PRODUCT DATA OF EQUIPMENT BEING INSTALLED ON THE PROJECT: After the Shop Drawings are approved, but prior to manufacture installation of any equipment, the architect and/or engineer has the right to make minor changes at no cost to the project. A brief description of submittal conditions is given below. Refer to identified sections for detailed submittal requirements.

C. Confirming and approving substitute equipment for the project.

1. Confirm that the substitute equipment is approved for installation before entering it into the base bid. It must be defined as to name, catalog number or both in a published addendum. **If not approved, do not enter in the base bid**.
2. Each unit shall state the name of the equipment manufacturer (name, address, phone, email, etc.) catalog number, size, physical dimensions and weight, energy characteristics (electrical and/or fuel), operating characteristics, materials from which constructed, any special conditions that may apply to the construction of the unit, etc.
3. The equipment must explain and define in detail the components that make-up the unit, so the owner and engineer can determine, define the replaceable parts during the life of the unit.
4. Complete operating instruction, normal maintenance recommendations, start-up procedures, etc.
5. In general, the contractor shall acquaint himself with the equipment to confirm that it can be installed as shown on the plans and from his experience perform the indicated function in the system where installed.

6. In the course of reviewing the shop drawings, the Contractor shall confirm the specified service pipe size, flows and water pressure are correct for the system being installed and determine if these services are available at the site. Availability of the serving water pipe sizes, etc., or if there are discrepancies in the services. If the indicated equipment services are not available, inform the engineer by phone and in writing, also note on the shop drawing. This cooperative effort will correct a problem before the equipment arrives at the job site.
   a. The shop drawings shall also indicate the scheduled delivery dates the equipment will be at the site.
   b. If the contractor foresees any problems with equipment size, delivery, etc., it shall be noted in writing, attached to the shop drawings.

1.10 RECORD DOCUMENTS

A. Contractor shall record differences between F.S. systems as installed and those indicated in Contract Documents on a set of prints of the F.S. drawings to be furnished by Engineer or Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 General Requirements.

1.11 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall prepare and submit Operation and Maintenance Manuals for Fire Sprinkler systems provided under this Contract. Comply with Division 01 requirements for procedures and requirements for preparation and submittal of manuals.

B. Manual binder shall have permanent lettering of a contrasting color. Information to be included on the binder is as follows:

Enter binder information below

C. The front cover shall be lettered as follows:

FIRE SUPPRESSIONS
OPERATION AND MAINTENANCE
MANUAL
(PROJECT NAME)
(CITY AND STATE)
(YEAR)

OWNER:	*(NAME)*
ARCHITECT:	*(NAME)*
F.S. ENGINEER:	Nielson Engineering Inc.
GENERAL CONTRACTOR:	*(NAME)*
F.S. CONTRACTOR:	*(NAME)*

The spine shall be lettered as follows:

F.S. O & M MANUAL (*Year)*
(Project Name)

D. Provide a master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.

E. Cover section shall consist of name, address, and phone number of Project Architect, General Contractor, Mechanical Engineer and F.S. Contractor.

F. Provide a separate section for each section of the specifications. Provide index for each section listing equipment included. Include all items specified in Sections 210501 through Last Section. Provide a list of each type of equipment supplied with the local supplier's name, address, and phone number.

G. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be original. Copies are not acceptable.

H. One (1) copy of the manual shall be submitted for review and approval by the Engineer. After approval, submit three (3) copies of manual to the Owner for approval unless otherwise directed by Division 1 requirements. Information to be included in manual:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Servicing instructions charts and schedules.
3. Schematic control diagrams (as built-status) for each zone and the total system.
4. Monitored valve schedule indicating the valve symbol (tag number), valve location by room number and description, valve purpose and system served, and valve size. Provide one corresponding set of F.S. prints (as-builts status) showing these valve locations for cross-reference. A second complete set of valve schedules (8½" x 11") encased in clear plastic laminate and fitted in an aluminum holding frame shall be furnished to the Owner.
5. Test records and certifications over the signature of the local fire authority.
6. Instruction period checklist.
7. Warranty information.

1.12 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. The Contractor shall instruct the Owner's Representative(s) in the Operation and Maintenance procedures described in the Operation and Maintenance Manual. Comply with Division 1 requirements.

1.13 GUARANTEE

A. Contractor shall guarantee the satisfactory operation of all material and equipment installed under section 210000 and shall repair or replace to the satisfaction of the Owner or Architect, any defective materials, equipment, or workmanship which may show itself within one year from the date of acceptance.

1.14 CLEANING

A. The Contractor shall, at all times, keep the premises free from accumulations of waste material or rubbish.

B. At completion of the job, the Contractor shall remove all tools, scaffolding, and surplus materials.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. All materials, in general, shall conform to the requirements of all agencies or publications specified and described in Division 01 of the Contract Specifications.

B. Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

C. All materials and equipment specified under this section shall be American manufactured and made.

2.2 SUBSTITUTIONS AND APPROVAL OF PRODUCT OPTIONS

A. Substitute equipment is encouraged if it is truly an equal to the specified items

1. The items and/or equipment specified in the contract documents are standard manufacturers items found in suppliers' catalogs, except it be indicated as special. The designer has taken time and effort to analyze, evaluate and prove to himself that the specified units will perform the function needed, wherein it is placed. This means the responsibility for the function of the specified equipment rests with the designer, who knows and understands what is to be accomplished.
2. If a **supplier** and/or the **contractor** desires to substitute equipment in place of a specified item, he may do so, but he takes upon himself or herself the **full responsibility** that the substituted equipment will equal all of the performing characteristics, functions, etc., and/or exceed the performance of the specified item. The substitute equipment shall be of such a physical size and weight that it will mount in the designated location without alterations to the building and the structure will carry the load. If for any reason the substituted equipment requires alterations or modification, in any form to the building and/or the structure, the costs shall be paid by the contractor and/or those requesting the substitutions.
3. Those interested in requesting a substitution shall submit a substitution request. The **substitution request will be considered if it is at the office of the Engineer eight (8) working days prior to the day of bidding. The request shall include the following:**
   a. **A statement certifying that the equipment proposed is equal to that specified; that it has the same mechanical operating characteristics, compatible dimensions, weight, electrical characteristics and meets the function and intent of the equipment named in the contract documents.**
   b. **The specification and catalog numbers of the substituted equipment.**
   c. **A pictorial and specification brochure.**

4. Because of the short bidding period, (from issuance of drawing to bid date), between the substitution request and the bid date, the designer does not have adequate time to make a full evaluation of substitute equipment. Therefore, **those requesting the substitution** must accept **full responsibility** for the items being submitted for substitution (operating characteristics, physical size, weight, output, not increase the load, etc.). If at anytime during the course of construction, **even up into the final completion**, if the designer finds the equipment does not meet the design criteria, comply with the performance, etc., **those requesting the substitution and the contractor have the responsibility to remove the substituted equipment and install the specified item at their expense.** There shall be no cost assessed to the owner and/or the designer and **the replacement will not delay the completion of the project.**

D. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents, nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer, who will issue interpretation and/or additional instructions to Bidders before the project is bid.

E. Any conflict arising from the use of **substituted equipment shall be the responsibility of the contractor,** who shall bear all costs required to make the equipment comply with the intent of the contract documents.

F. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

G. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued. This substitution may be made by a change order.

H. Substitute equipment shall not be bid except it is formally issued on a Project Addendum.

PART 3 - EXECUTION

3.1 COORDINATION AND WORKMANSHIP

A. The Contractor shall at all times cooperate with other trades on the job to avoid friction and delay to the progress of work. All points in dispute shall be referred to the Architect.

3.2 SUPERVISION

A. This Contractor shall have in charge of the work at all times a thoroughly competent superintendent. Comply with Division 01 requirements.

3.3 WORKMANSHIP

A. The work under the fire sprinkler contract shall be performed by Journeyman workers skilled in the particular trade and include all work necessary to properly complete the installation in a professional manner so as to present a neat and finished appearance.

3.4 EXAMINATION OF SITE

A. The Contractor shall visit the site of the proposed work and become familiar with the point of service connection. Contractor shall verify and accept the location of the service before beginning his work.

3.5 SITE UTILITY SERVICES

A. The Contractor shall make connections to existing permanent cold water service at the indicated location. Comply with Division 01 and 02 requirements.

If not remodel remove

3.6 EXISTING UTILITIES AND F.S. SYSTEMS

A. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a 10' radius of the indicated locations. Where connection points are not within this radius, the Contractor shall contact the Architect for a decision before proceeding or may proceed at his own expense.

B. Existing piping (cold water connection), that are found to obstruct the construction area (walls, floors and ceilings) and obstruct the removal of a wall, doorway or passageway, etc., shall be rerouted and/or relocated to clear the construction. The cost for this work shall be included as a part of the project and shall be covered in the contractor's base bid.

C. If systems of other trades or exhaust ducts fall within or obstruct construction area for whatever reason, the contractor shall relocate these items to allow construction to proceed. The cost for this work shall be included as a part of the base bid.

D. Existing extensions: piping that are noted to be extended and/or retrofit (for whatever reason) to accommodate added and/or new areas or facilities shall accomplish the intent for which the system was designed. When complete, the system and/or systems shall function as if they were new. This work shall be included in the base bid for the project.

Note: The specifications identify each system herein mentioned and the extension and additions shall adhere to the specifications defined for this phase of construction.

3.7 LAYING OUT WORK

A. Locations of all equipment shown on the drawings, is approximate unless dimensioned. Exact locations of such items shall be determined by the Architect's representative and/or secured from special details and drawings. Verify the physical dimensions of each item of fire sprinkler equipment to fit the available space and promptly notify the Architect/Engineer prior to roughing-in if conflicts appear. Coordination of equipment to the available space and to the access routes through the construction shall be the Contractor's responsibility.

B. The contractor **shall hand deliver to the general contractor** a written statement and/or a manufacturer's brochure on the equipment being installed at each location. The information shall give the dimensions and weight (loads) of each unit being installed. The general contractor shall forward a copy of this information to the structural engineer and obtain from him confirmation that the building structure will accommodate the loads. If there be any problem the questioning party shall notify the mechanical engineer by phone and in writing.

3.8 CONTRACTOR COORDINATION

A. In the course of installing the systems defined in the contract documents, the contractor shall closely follow the plans, details and specifications (contract documents). The system design has been a careful and laborious undertaking, with the intent purpose of producing a system and/or systems that will serve the owner well with a minimum of maintenance. Thence, the contractor shall adhere as closely as possible to the plans, details, and specifications for each system. Questions and suggestions are encouraged as the project is being assembled. If for any reason, the contractor feels to deviate from the defined information, and finds a way, to improve the system, to make the system more easily assembled, make it operate more efficiently, etc., the contractor shall suggest the change to the engineer. Systems are designed to perform a specific function; the most minute change in assembly may change the function. If the engineer agrees with the change, he will authorize the contractor to proceed. Contractor cooperation and coordination is appreciated. If the contractor proceeds with the construction, without the designer's authorization, it shall be reworked, in accordance to plans and specifications, which work shall be at the contractor's expense.

B. The contractor shall coordinate his construction. These systems, location of equipment, connections of services, etc. with the architectural, Plumbing 220000, HVAC sector 230000, electrical 260000 documents throughout the course of construction. If problems are unsolvable contact the design engineer.

3.9 CUTTING AND PATCHING

A. All cutting and patching of new or existing construction required for installation of the F.S. systems and equipment specified in Section 210000 shall be the responsibility of the F.S. Contractor unless otherwise noted. Comply with Division 01 for general requirements for cutting and patching.

B. All cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. All patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

E. Perform cutting, fitting, and patching of F.S. equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.

F. Upon written instructions from the Architect/Engineer, uncover and expose work to provide for the Architect/Engineer the ability for observation of concealed work.

G. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

H. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.10 EXCAVATION AND BACKFILL

A. Contractor shall provide all necessary excavation, shoring, and backfilling required for proper installation of fire sprinkler work inside and outside the building. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 2 the depth of the excavation, but in no instance closer than 2". Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of in designated areas approved for surplus material storage. Grading shall be done as necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained.

B. Trenches shall be excavated to depth indicated or required to establish indicated slope and invert elevations and to support bottom of piping or conduit on undisturbed soil. Trenches shall be of uniform width, sufficient to provide ample working room and a minimum of 6" to 9" of clearance on both sides of pipe or conduit.

C. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3" or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing. Where unyielding material is encountered in the bottom of the trench, such material shall be removed 6" below the required grade and replaced with materials described below for bedding.

D. Excavation for manholes, basins, inlets, or similar structures shall be sufficient to leave at least 12" clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

E. Bedding material shall be clean, sand-gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D 422.

U.S. Standard	Percent Passing Sieve Size
1"	100
No. 4	25-80
No. 200	0-10

F. Bedding material shall be placed to a depth of 6" over the top of piping. The bedding shall be brought up evenly on both sides of the pipe for the full length of the pipe.

G. Backfill for the remainder of the trench shall be satisfactory soil materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

H. Backfill soil materials shall be free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

I. Backfill to the required grade shall be placed in lifts not exceeding 6" loose thickness for compaction with hand operated machine compactors, and 8" loose thickness for other than hand operated machines otherwise specified. Each layer shall be compacted to density 105% of the adjacent soil density or as stated in the soil compaction section of these documents.

J. No underground lines shall be covered until the installation has been approved by the inspector having jurisdiction and the Owner's Representative.

K. Provide 4” thick concrete base slab support for piping less than 2' - 6" below surface of roadways. After installation and testing of piping, provide minimum 4” thick encasements (sides and top) of concrete prior to backfilling or placement of roadway subbase.

L. Bracing and shoring shall be provided where depth of excavation or character of ground render it necessary for personnel protection. Shoring shall be constructed of heavy timber planking with timber supports and shall conform with local and state safety laws and regulations.

M. Removal of bracing and shoring materials shall be done before backfilling except where necessary to insure against caving; in which case, it shall be withdrawn while backfilling is being done.

N. Provide barricades around all excavation. Barricades to be securely constructed.

O. The Contractor shall exercise extreme care while excavating in the area of utilities, carefully check for location of all possible utilities, whether shown on the drawings or not, and establish the location of all cutoff valves for ready shut-off of service in case of emergency. The Contractor shall be completely responsible for all damage to any utilities caused in excavating as well as damage to personnel and property caused by said damaged utilities whether shown on the drawings or not.

3.11 REPLACEMENT OF PAVING AND CONCRETE

A. All existing or new sidewalks, concrete paving, curbs, or asphalt paving removed or damaged by this Contractor during the period of the installation or as a result thereof, shall be replaced with like material in a manner as directed by and to the satisfaction of the Owner's Representative. Comply with Division 02 General Requirements.

3.12 OPENINGS IN PIPES

A. All temporary openings in pipes shall be capped or sealed during construction. Caps shall be removed for final connections.

3.13 PROTECTION OF MATERIALS AND EQUIPMENT

A. Contractor shall be held responsible for any and all materials and equipment to be installed under this contract and will be required to make good at his own cost any injury or damage which materials or equipment may sustain from any source or cause whatsoever before final acceptance. Comply with Division 1 requirements.

3.14 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of F.S. materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.15 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Access doors or hatches required for servicing of the F.S. equipment shall be furnished and installed by the F.S. contractor of the type specified in the other Sections of the Specifications.

3.16 PAINTING

A. Contractor shall touch-up scratched or damaged factory finishes of fire sprinkler equipment. Comply with Division 01 requirements.

3.17 CLEANING

A. Remove dirt, grease, and other foreign matter from each length of piping before installation.

1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove all stickers.

3.18 FINAL CLEANING

A. Refer to Division 1 for general requirements for final cleaning.

B. At time of final cleanup, all heads and equipment shall be thoroughly cleaned and left in condition for use.

3.19 FIRE PENETRATION SEALS

A. All penetrations through fire rated floors and walls shall be sealed to prevent the spread of smoke, fire, toxic gas, or water through the penetration either before, during or after a fire. The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed so that the original fire rating of the floor or wall is maintained.

B. The sealant shall remain soft and pliable to allow for the removal and/or addition of piping without the necessity of drilling holes. It shall adhere to itself to allow any and all repairs to be made with the same material. It shall permit the vibration, expansion and/or contraction of piping and ducts going through the penetration without the seal cracking or crumbling.

C. When damming materials are to be left in place after the seal is complete, all such materials shall be non-flammable.

D. When sealant is injected into a penetration, the foam shall expand to surround all items within the penetration and maintain pressure against the walls of the penetration. The foam shall cure within five minutes and be fire resistant at that time. No heat shall be required to further expand the foam to block the passage of fire and smoke or water.

***Remove Excess Foam-Leave A Clean Surface. ***

E. All wall or floor penetration openings shall be as small as possible.

F. The foam sealant shall meet all of the fire test and hose stream test requirements of ASTM E119-73 and shall be UL classified as a Wall Opening Protective Device. The sealant shall be CHASE-FOAM, CTC PR-855 Fire Resistant Foam Sealant from Chase Technology Corporation, Huntington Station, New York 11746 or 3M Brand Fire Barrier caulk CP25, putty 303, wrap/strip FS 195 or sheet CS 195 from 3M Products Divisions, 224-4N 3M Center, St. Paul, MN 55144-1000.

3.20 TESTING, CERTIFICATION, AND GUARANTEE

A. The fire sprinkling systems shall be pressure tested in strict accordance with local and state codes by contractor experience in pressure testing. The report shall be stamped by a licensed certified fire sprinkler. The Fire Sprinkler Contractor shall include in his base bid all costs for tests.

B. Testing of fire sprinkler systems shall not be made until the code conditions are satisfied.

C. All instruments used for measurements shall be accurate and calibration histories for each instrument shall be available for examination. The Mechanical Engineer has the right to request instrument recalibration, or the use of other instruments, where accuracy of readings is questionable.

D. Furnish in the report a written guarantee to be effective for one year from the date of acceptance, to make any and all adjustments required to maintain comfort in all rooms and areas.

3.21 REPORTS

A. Upon completion of testing, the F.S. system, prepare a complete and legible draft report. Submit two (2) copies of the draft report to the Design Engineer for review. The report shall be signed by the local governing authority.

B. Upon verification and approval of the draft reports, prepare final reports. Four (4) typewritten, organized and formatted copies of the final report are required. Furnish one (1) copy to the Design Engineer for his record, and the remaining three (3) copies are to be included in the Owner's Operation and Maintenance Manuals.

END OF SECTION 210501

SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions section 01 and Section 220501 apply to this section.

B. Types of pipe and fittings as specified under each section.

1.2 SUMMARY

A. Included but not limited to

1. All domestic water lines (hot, cold, return, service, etc. being installed under the contract documents.

1.3 QUALITY INSURANCE

A. Rigid pipe hangers shall carry 5 times the load. See details on the plans.

1.4 PRODUCTS

A. Adjustable, malleable iron device type of a diameter adequate to support the pipe size see schedules below.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Hangers, Rods, and Inserts:

1. Galvanized and UL approved for service intended.
2. Hangers and accessories shall be Grinnell numbers specified or equals by B-Line.
    a. Support horizontal piping from clevis hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on drawings. Hangers shall have double nuts.
    b. Support insulated pipes with clevis hanger equal to Grinnell Fig 260 or roller assembly equal to Grinnell Fig 171 with an insulation protection shield equal to Grinnell Fig 167. Gauge and length of shield shall be according to Grinnell design data.
    c. Support uninsulated copper pipe from Grinnell Fig CT-65 copper plated hangers and clevis hanger equal to CT97 Loop Hanger.

3. Support rods for single pipe.

Rod Diameter	Pipe Size
3/8″	2″ and smaller
½″	2-1/2 to 3-1/2“
5/8″	4 to 5“
¾″	6″
7/8″	8 to 12″

4. Support rods for multiple pipe supported on steel angle trapeze hangers:

Rods		Number of Pipes Carried, of Sizes Listed						
Number	Diameter	2″	2½″	3″	4″	5″	6″	8″
2	3/8″	2	--	--	--	--	--	--
2	½”	3	3	2	--	--	--	--
2	5/8″	6	4	3	2	--	--	--
2	¾″	9	7	5	3	2	2	--
2	7/8″	12	9	7	5	3	2	2

5. Size trapeze angles so bending stress is less than 10,000 psi.
6. Riser clamps for vertical piping: Grinnell Figure 261.
7. Concrete Inserts
   a. Grinnell Figure 282
   b. Suitable for special nuts size 3/8” through 7/8” with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
   c. Continuous inserts shall be Unistrut P-3200 series.

8. Steel deck bracket: Unistrut P1000 with clamp nut, 6” length minimum.

2.2 MANUFACTURERS

A. Contact Information

1. B-Line Systems, Highland, IL www.blind.com
2. EPCO Products Inc, Fort Wayne, IN www.epcoproducts.com
3. Globe Pipe Hanger Products Inc, Cleveland, OH www.globepipehanger.com
4. Grinnell Corp, Lansdale, PA www.grinnell.com
5. Michigan Hanger Company, Niles, OH (800) 333-0852 or (330) 544-4700.
6. Superstrut by Thomas & Betts, Memphis, TN www.tnb.com
7. Victaulic Company of America, Easton, PA or Victaulic Company of Canada, Rexdale, ON www.victaulic.com
8. Watts Regulator Co, North Andover, MA www.wattsreg.com

END OF SECTION 210529

SECTION 210548 - VIBRATION AND SEISMIC CONTROL FOR FIRE SPRINKLING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

B. Section 033111 Cast-In-Place Concrete

C. Furnishing and installing of seismic restraint and vibration isolation systems is by installer of fire sprinkler equipment requiring such systems. Manufacturers of equipment specified for seismic restraint equipment requiring such systems sent. Manufacturers of equipment dimensions, dimensioned anchor points, operating weight, and center of gravity dimension.

1.2 SUMMARY

A. Includes but not limited to

1. Quality of and requirements for anchorage and seismic restraint systems and vibration isolation systems for piping and fire sprinkler equipment.

1.3 REFERENCES

A. American Society for Testing and Materials

1. ASTM A 615-04b, ‘Standard Specification for Deformed & Plain Billet-Steel Bars for Concrete Reinforcement’.

B. Sheet Metal & Air Conditioning Contractors National Association/American National Standards Institute.

1. SMACNA/ANSI 001-2000, ‘Seismic Restraint Manual: Guidelines for Mechanical Systems.’

1.4 SUBMITTALS

A. Product Data

1. Restraint system and anchorage method to be used for each piece of equipment.
2. Seismic restraints and calculations for all flexible mounted equipment.
3. Vibration isolators and flexible couplings.
4. Clearly outlined procedures for installing and adjusting isolators, seismic bracing anchors, and snubbers.

B. Shop Drawings

1. Show size, hanger length, and location of seismic restraints for piping.
2. Show details for each isolator and seismic brace with snubbers proposed for specified equipment.
3. Show details for proposed structural steel frames and rails and for anchors to be used in conjunction with isolation of equipment.

4. Show locations of piping restraints on installation and fabrication floor plans (not bid set of documents of floor plans), noting size and type of restraint to be used.
5. Show details of supports, hangers, anchorage, and bracing for isolated equipment as designed or proposed by professional engineer employed by Restraint Manufacturer and qualified with seismic experience in bracing for fire sprinkler equipment. Shop drawings submitted for seismic bracing and anchors shall bear engineer's signed professional seal.
6. Include anchor bolt calculations, signed, and stamped by registered engineer, showing adequacy of bolt sizing and type.
    a. Calculations shall include anchor embedment, minimum edge distance and minimum center distance.
    b. Design lateral forces shall be distributed in proportion to mass distribution of equipment.
    c. Furnish calculations for anchors on restraint devices, cable, isolators, and on rigidly mounted equipment.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: System design and installation shall meet seismic requirements as defined in current edition of International Building Code, Section 1621 and applicable state and local codes in accordance with Seismic Zone 3 with minimum restraint capability of 1.0 g. Explicit requirements and details can be found in referenced SMACNA Manual.

B. Seismic Requirements: Fire Sprinkler equipment and piping shall be braced, snubbed, or supported to withstand seismic disturbances and remain operational.

C. Vibration Isolation Requirements: Isolate equipment from structure by means of resilient vibration and noise isolators.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Isolation and Seismic Equipment:

1. Piping: Restrain piping in accordance with Figures 4.11 to 4.19 in SMACNA Manual.
2. Equipment with Fixed Anchor or Support:
    a. Restraint designed according to Sections 1621 and 1622 of International Building Code.
    b. Horizontal force factor for elements of structures:
        1) In addition, vertical force restraint requirement shall be computed at 1/2 value of horizontal forces.
        2) Restrain equipment not anchored directly to floors by cable system designed and furnished by Restraint Manufacturer.

B. Vibration Isolation Requirements:

1. Design and install isolation equipment, hangers, connections, and other isolating devices to prevent transmission of vibration to structure from equipment and associated piping.
2. Overhead Support Spring and Rubber Hangers:
    a. Combination spring and neoprene hangers.
    b. Hanger bracket shall have 500% overload capability and shall allow up to 15º hanger rod misalignment without short-circuiting.
    c. Springs shall have 50% overload capacity.

d. Provide seismic bracing as required.

3. Isolate piping in mechanical equipment rooms and piping three supports away or 50' from other mechanical equipment, whichever is greater, from structure by means of vibration and noise isolators.
   a. Isolate suspended piping with combination spring and fiberglass hangers in supporting rods.
   b. Support floor-mounted piping directly on spring mounts.

4. Isolate vertical pipe risers from structure using vibration and noise isolating expansion hangers having minimum rated deflection of four times anticipated pipe movement. Enclose in housing for fail-safe equipment.
5. Incorporate flexible connectors in piping adjacent to reciprocating equipment.
6. Nuts, Bolts, and Washers: Electroplated zinc.
7. Isolators Exposed to Weather: Cadmium plated and neoprene coated springs.

C. Seismic restraint equipment and resilient isolation devices shall be designed and furnished by single Manufacturer:

D. Type One Acceptable Manufacturers:

1. Amber / Booth Company, Houston, TX www.amberbooth.com.
2. Mason Industries Inc, Hauppauge, NY www.mason-ind.com.
3. Vibration Mountings and Control Inc, Bloomington, NJ (201) 838-1780.
4. Equal as approved by Architect before bidding. See Section 01 6000.

2.2 FINISHES

A. Clean and paint steel components. Thoroughly clean structural steel bases of welding slag and prime with zinc-chromate or metal etching primer. Etch and paint hot dipped galvanized steel components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Isolation Equipment:

1. Piping:
   a. Protect isolated and non-isolated piping 2½" inside diameter and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motions.
   b. Locations shall be as scheduled and include, but not be limited to:
      1) At drops to equipment and at flexible connections.
      2) At 45º or greater changes in direction of pipe.
      3) At horizontal runs of pipe 30' maximum on center spacing.

B. Vibration Isolation: Install piping and ductwork to prevent transmission of noise and vibration into structure.

END OF SECTION 210548

SECTION 210553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPES AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and section 220501 apply to this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install identification of equipment and piping as described in Contract Documents.

PART 2 - PRODUCTS

2.1 PAINT

A. Benjamin Moore Impervo or equivalent by Paint Manufacturer approved in Architectural Painting Sections.

B. Use appropriate primer.

2.2 LABELS

A. 1/8" Laminated Black Formica with white reveal on engraving.

B. Self-Sticking vinyl marker for indoor and outdoor and meets ASME (ANSI) Standard A13.1. Vinyl markers as manufactures by Seton and Brady.

PART 3 - EXECUTION

3.1 APPLICATION

A. Self-Sticking Vinyl Maintenance

1. Locate identifying legends and directional arrows at following points on each piping system
   a. Adjacent to each item of equipment and special fitting.
   b. At point of entry and exit where piping goes through wall.
   c. On each riser and junction.
   d. Every 50’ on long continuous lines.
   e. Letters shall be 1” high. Provide "Direction of Flow" arrow at each stencil.
   f. Paint color shall be as specified below.

B. Identification shall comply with, but not limited to the following:

PIPE PAINTING AND LABELING LEGEND

SERVICE & LABEL	SYMBOL	LABEL COLOR * BACKGROUND	LETTER	PIPE COLOR **
FIRE SPRINKLER	F	RED	WHITE	RED

* Ref. ANSI codes 13.1 (1981). See Specs.

** Exposed piping in mechanical rooms, boiler rooms, etc., shall be painted color indicated on chart.

C. SIZE OF LETTERS AND LENGTH OF FIELD

OD OF PIPE OR COVERING	SIZE OF LETTERS	LENGTH OF COLOR FIELD
¾" To 1½"	½"	8"
1½" To 2"	¾"	8"
2½" To 6"	1¼"	12"
8" To 10"	2½"	24"
Over 10"	3½"	32"

D. Paint Specification: All surfaces to be painted shall be prepared in accordance with the detailed painting specifications in the Painting Section of these specifications. Surfaces that are not subjected to temperatures higher than 212º F shall be painted as specified for the area in which they are located. Pipes, valves or other equipment subjected to temperature above 212° F, shall be painted with heat resisting black enamel or heat resisting aluminum paint as specified below. The Owner's Representative shall designate surfaces to be painted aluminum painted at least three coats. Colors shall be selected by Owner's Representative.

E. Heat resisting black enamel shall be Sta-Black as manufactured by Pratt and Lambert Co., or Ebonite Boiler and Stack Paint as manufactured by W.P. Fuller Co. or approved equal suitable for use at temperatures of at least 450° F.

END OF SECTION 210553

SECTION 210716 - FIRE SUPPRESSION WATER SERVICE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. Refer to the Fire Sprinkler site plan for Fire Suppression service water connection

B. Provide and install backflow valves or other equipment as required by local code.

C. Provide and install PIV valves as required by NFPA 13 and local codes

1.3 REQUIREMENTS

A. All piping connections, valves, etc. shall comply with NFPA and local codes.

B. All materials and equipment specified under this section shall be American manufactured and made.

1.4 QUALIFICATIONS

A. Only qualified and certified mechanics shall make this connection.

PART 2 - EXECUTION

2.1 EXECUTION SUMMARY

A. The connection at the point of service shall be in strict accordance with NFPA, and local codes.

B. Materials only code approved piping and fittings shall be used in making the service connection.

C. Refer to Section 220501 on excavation and backfill related to the service connection.

END OF SECTION 210716

SECTION 210719 - FIRE SUPPRESSION PIPE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. Includes But Not Limited To

1. Furnish and install insulation on:
   a. Above ground Fire Suppression Piping, fittings, valves, and accessories as described in Contract Documents or noted on the drawings.

PART 2 - PRODUCTS

2.1 INSULATION

A. 1” thick for 1" to 2" pipe and 2” for 2" and larger snap-on glass fiber closed cell polyolefin or elastomeric pipe insulation.

B. On piping, fittings, valves, etc. 2" and larger install 2” insulation on 2" and larger with factory vapor jacket equal to Fiberglas ASJ may be used.

C. Below grade joints shall be sealed with category four products

1. Armacell 5200
2. Rubatex R373

D. Approved Manufacturers

1. Manville
2. Owens-Corning
3. Knauf
4. IMCOA "ImcoLock"
5. Armstrong "Armaflex"

2.2 PVC FITTING, VALVE, & ACCESSORY COVERS

A. Approved Manufacturers

1. Knauf
2. Zeston

PART 3 - EXECUTION

3.1 APPLICATION

A. Piping

1. The insulation must be continuous, even through supports (at supports install a split PVC pipe to cover insulation then clamp the split PVC to the support).
2. Apply insulation to clean, dry piping with joints tightly butted.
3. Adhere "factory applied vapor barrier jacket lap" smoothly and securely at longitudinal laps with a white vapor barrier adhesive.
4. Adhere 3” wide self-sealing butt joint strips over end joints.
5. All joints and insulation ends shall be sealed in accordance with the manufacturers’ and industry practices.

B. Fittings, Valves, & Accessories

1. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
2. Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
3. Alternate Method
    a. Insulate fittings, valves, and accessories with 1” of insulating cement and vapor seal with two 1/8” wet coats of vapor barrier mastic reinforced with glass fabric extending 2” onto adjacent insulation.

C. Pipe Hangers

1. Do not allow pipes to come in contact with the support hangers.
2. Provide 16 ga x 6” long galvanized or PVC split shield over the insulation at each pipe hanger to protect pipe insulation from crushing by clevis hanger.

D. No insulation shall be applied until piping has been pressure tested and approved.

1. In all cold attic situations where the building insulation is located at the ceiling, all piping installed in the ceiling to roof space shall be insulated as specified herein.
2. In addition, install at 6" thick by 30" wide fiberglass blanket with vapor barrier (vapor barrier towards warm side of cavity) over the pipe to tent and allow heat loss through the ceiling to prevent the pipe from freezing. The insulation blanket shall be held in place by rolling it on a wood lathe and nailed to the joist. The building insulation shall then be applied over this pipe protection insulation.

E. Underground insulation shall be covered by slipping the insulation onto the pipe and sealing the butt joints. If slip-on is not possible, cut the insulation, install, then seal the seams and joints.

1. Insulation
    a. ½” thick Armaflex standard pipe insulation.
    b. Equals by Rubatex or IMCOA “Imcolock”
    c. All joints shall be sealed with Armstrong 520

F. In room installations where excess moisture or humidity will be present, only the polyolefin or elastomeric insulation shall be used.

END OF SECTION 210719

SECTION 211200 -STANDPIPE AND FIRE HOSE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions and Division 01 apply to this Section.

B. Division 21 - Fire extinguishers and cabinets.

C. Section 230553 applies to this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install fire hose system as described in Contract Documents.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements

1. Installation shall conform to local plumbing and fire protection codes and relevant NFPA standards.

B. Components shall be UL approved if applicable.

C. All materials and equipment specified under this section shall be American manufactured and made.

1.4 SEQUENCING & SCHEDULING

A. Coordinate with other Sections to assure proper wall openings and compatibility with specified fire extinguishers.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Piping

1. Type L copper with wrought copper fittings. Connections shall be sweat copper type with 95/5 solder.

B. Valves

1. 1½", 150 lb, chrome plated brass angle valve. Valve shall be UL listed and have female NPT inlet and male hose thread outlet. Provide 1½" valve escutcheon plate.

C. Cabinets

1. Combined fire hose and fire extinguisher cabinets shall be two piece type steel tub with white baked enamel inside, knock-out plugs in each corner, aluminum door and pull handle tension latch, full length hinge, lock and key, break glass door, aluminum recess trim (reversible for right or left hand hinge). Hose rack shall be chrome plated.

D. Hose

1. Fire hose shall be 1½" diameter x 75' flexible fold hose with all neoprene tube covered with Dacron filler and long staple cotton warp yarn woven for maximum strength and flexibility. Equip with quick opening and closing fog chrome plated nozzle.

E. Approved Manufacturers

1. Allenco
2. Elkhart Brass
3. Potter Roemer
4. Seco
5. Standard

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount cabinets plumb and square with trim providing a neat fit with wall surfaces. Meet codes for height.

END OF SECTION 211200

SECTION 211310 - FIRE SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section.

B. Requirements of Mechanical General Provisions Sections govern the work specified in this section except that NFPA 13 shall take precedence.

C. Division 21 Section “Fire Alarm Systems” for connection of valves and alarms.

1.2 SUMMARY

A. The extent of the fire sprinkler system design and installation shall meet the requirements of NFPA 13 and meet the requirements as shown on Contract drawings and specifications. The completed system shall include all those items necessary to make the fire sprinkler system complete and operational.

1.3 APPLICABLE CODES

A. NFPA 13

B. Underwriters Laboratories “Fire Protection Equipment Directory”.

C. Factory Mutual Systems “Loss Prevention Data Sheets” where applicable and “Approval Guide”.

D. Applicable local building and fire prevention codes and ordinances.

1.4 SYSTEM DESCRIPTION

A. Fire sprinkler protection for the building shall be complete as defined by NFPA 13 and the local jurisdiction. The extent of fire sprinkler system installation shall be defined to include all those items necessary to make the system complete and operational and is to include but is not necessarily limited to: Approved design and layout drawings, underground supply, supply mains, backflow preventer, sprinkler riser including fire department connection, alarm devices and valves, gauges, control and test valves, pipe hangers, sprinkler heads, seismic bracing, and identification signs. The sprinkler contractor is required to provide complete fire sprinkler protection of the building as defined by NFPA 13 unless otherwise specifically required by these specifications.

1.5 QUALITY ASSURANCE

A. The standards of NFPA 13 shall take precedence.

B. Sprinkler Contractor shall be licensed as a fire sprinkler contractor in the State of Idaho.

C. All materials, devices, and equipment shall be new and shall be Underwriter’s Laboratory listed and/or FM approved for use in fire protection systems.

D. Drawings for sprinkler system design included in the Contract Documents are for reference only. Fire Sprinkler Contractor is responsible for making his own field verification of the job and provide complete design shop drawings with hydraulic calculations prior to fabrication. Make final coordination with other trades and off-set piping and heads, as necessary. Major conflicts shall be brought to the attention of the General Contractor for resolution by the Architect.

E. Data files for drawings may be requested from the Project Architect. A hold-harmless agreement signed by the General Contractor and Sub-contractor will be required before files are released.

F. Do not connect to underground water supply mains provided by others without receiving a copy of the "Contractor's Material and Test Certificate" with certification that all flushing and pressure testing of the mains has been completed. Meet all NFPA 13 requirements and local codes.

1.6 SYSTEM DESIGN

A. Sprinkler protection for the building shall be complete as defined by NFPA 13 and local jurisdiction. All design densities, system protection area limitations, and the hydraulically most demanding remote area square footage shall be per NFPA 13, including any combustible ceiling spaces or around any building features which obstruct sprinkler discharge. Any areas subject to freezing shall be protected with a dry system or a propylene glycol anti-freeze system per NFPA 13 and local jurisdiction.

B. The Fire Sprinkler Contractor/CET shall perform a current waterflow test. This test shall be witnessed by or provided by the local authority having jurisdiction. This waterflow test information and date of the test shall be provided along with hydraulic calculations, shown on the design shop drawings.

C. Design density shall be as follows:

1. Light hazard occupancy shall meet a minimum design density of 0.10 over 1500 ft^2.
2. Ordinary hazard, group 1 occupancy shall meet a minimum design density of 0.15 over 1500 ft^2.
3. Ordinary hazard, group 2 occupancy shall meet a minimum design density of 0.20 over 1500 ft^2.

D. Contractor is responsible for coordination of piping and sprinkler head locations with other trades, including any minor offsets as may be required. Where conflicts occur, they shall be resolved prior to installation. Major conflicts shall be brought to the attention of the General Contractor for resolution by the Architect. Coordinate system layout so as not to interfere with light fixture arrangement and air outlets. Sprinkler heads shall be centered in ceiling tiles. Use equal to Vic Flex Hose to center heads.

E. Wiring of waterflow and valve supervisory switches for local alarms and off-premises monitoring is provided for under Division 16 Section "Fire Alarm Systems".

F. Seismic bracing shall be provided as required by NFPA 13.

G. Sprinkler piping shall be concealed above the ceiling where ceilings are present.

H. Provide identification signs for all control, drain, test, and alarm valves. Attach hydraulic criteria placard permanently to the main riser. Where control valves are located in closets or above ceiling, provide appropriate identification sign on closet door or on ceiling.

1.7 SUBMITTALS

A. Shop drawings shall be prepared by a registered Engineer or a fire Sprinkler Senior Engineering Technician (Level III or Level IV) NICET certification shall be provided for the fire sprinkler design. Include NICET certification number on drawings. Drawings will be signed by the Engineer or Technician and submitted for approval under his or her name.

B. No equipment submittals are required. All equipment used in the fire sprinkler system design and installation shall be clearly indicated on the plans, including manufacturers name and model numbers.

C. Prior to fabrication, prepare shop drawings for submittal to the State Fire Marshal or authority having jurisdiction. After review and acceptance by the State Fire Marshal, submit seven (7) sets of approved drawings and hydraulic calculations to the Architect for review and acceptance.

D. Do not proceed with fabrication or installation until all required approvals have been obtained.

E. Upon completion of the system, a fire sprinkler engineer or CET shall document the 2” drain test, inspect the general system installation, and verify that the installation is complete and installed according to the approved drawings and specifications. Minor corrections and/or additions to the drawings shall be red lined on the record drawings. The Contractor shall submit required record drawings, CET form and test certificates to the Contractor for submittal to Owner. In addition, the Contractor shall also submit the following items directly to the Architect:

1. One set of blue line drawings marked As-Builts with appropriate corrections or additions.
2. Copy of Contractors Material and Test Certificates for overhead and underground piping.
3. Copy of CET Final Inspection Form

F. Final payments will not be released until all submittals, as-builts, documentation and certificates have been provided.

PART 2 - PRODUCTS

2.1 PIPING

A. Above Ground

1. Pipe and Fittings: Pipes and fittings 2½" and larger shall meet the requirements of N.F.P.A. Standard #13. Piping 2" and smaller shall be standard wall schedule 40 black steel pipe. Fittings shall be class 150 malleable iron threaded.
2. Victaulic couplings, valves fittings and specialty items may be used in lieu of welded, flanged, or threaded connections. Grade "E" gaskets shall be used up to a maximum operating temperature of 230°F. Where Victaulic system is used, Victaulic S/700, S/703, S/704 butterfly valves and S/715 check valve may be used where accepted by local authorities, insurance underwriters and NFPA standards.

3. Flexible fire sprinkler drops are approved to use to feed fire sprinkler heads. Hose shall be FM and UL listed. Maximum length of flexible hose is 6’.
4. Pipe Hangers: All hangers shall be a type approved by the local fire department and installed as per NFPA and local requirement for spacing of hangers and pipe sizes.

B. Below Grade

1. All Areas
   a. Bell and spigot cast iron, AWWA Standard, Class 150 with fittings to match.

2. Outside Building Area
   a. Transite Class 150 Industrial Pressure Pipe with Ring-Tite couplings, AWWA C400-53T. Fittings shall be cast iron pressure fittings with Ring-Tite bells, AWWA C100-55.
   b. If local codes permit, Manville's "Blue Brut" UL labeled PVC pipe and fittings may be used.

C. No piping shall be used with a Corrosion Resistance Ratio of less than 1.00.

D. All piping used on dry pipe system shall be Schedule 40 or hot-dipped galvanized.

E. Special pipe such as XL pipe or Lightwall Threadable pipe shall not be used.

F. All piping shall be in conformance with NFPA 13 requirements.

2.2 VALVES

A. Valves used with below grade pipe shall be cast iron pressure type.

B. Post Indicator Valves (Where required)

1. AWWA and UL listed, with standard indicator post flange and post similar and equal to Kennedy #5412 series with post extensions as required.
2. Approved Manufacturers
   a. Kennedy
   b. Grinnell
   c. Equal as approved by Architect prior to bidding. See Architectural Section.

C. Gate Valve - Butterfly or OS&Y

D. Check Valve - Swing or wafer type.

E. Provide USC listed backflow preventor if required by local water district.

2.3 FITTINGS

A. All fittings shall meet requirements of NFPA 13

B. No plain-end fittings shall be allowed.

2.4 SPRINKLERS

A. Nominal ½" orifice for ordinary temperature classification rating unless other indicated or required by application.

B. Install concealed flush heads with cover, or equal as approved by Architect prior to bid, in occupied areas.

1. Use sprinklers according to the following applications:
    a. Recessed, chrome, pendent sprinklers in public areas.
    b. Upright, brass sprinklers in mechanical and electrical rooms.
    c. Dry pendent in entry vestibules and any other spaces subject to freezing.
    d. Pendant type may be installed in Storage Rooms, Custodial Rooms, and in concealed spaces.
    e. Install side wall type in elevator shaft.

C. O-Ring sprinklers are not allowed.

D. All sprinklers shall be installed in a workmanlike manner in respect to ceiling layout with pendent sprinkler heads to be located in the center of the tile ceiling grid. Use equal to Vic Flex Hose to center heads.

E. Install wire guards where required for protection.

F. Furnish spare heads of each type and temperature rating used, properly boxed with sprinkler head wrench as required by NFPA 13.2-2.7.

G. Approved Manufacturers

1. Star
2. Grinnell
3. Viking
4. Reliable
5. Equal as approved by Architect prior to bidding. See Architectural Section.

2.5 TRIM

A. Water motor, alarm gong, 10” in diameter.

B. Pressure gauge

C. Testing bypass

D. Escutcheon Plates

1. Chrome or nickel plated and installed on pipes through finished wall, floors, or ceilings.
2. Approved Manufacturers
    a. B&C #10
    b. Equal as approved by Architect prior to bidding. See Architectural Section.

2.6 FIRE DEPARTMENT CONNECTION

A. 4" x 2-1/2", polished brass standpipe mount type with turn down Siamese connection and built in check valve.

2.7 UNDERGROUND VALVE BOXES

A. Concrete box with traffic weight cast iron lid marked for service.

B. Approved Manufacturers

1. Christy
2. Brooks
3. Equal as approved by Architect prior to bidding. See Architectural Section.

2.8 FLOW SWITCH

A. Provide with built-in retard, retarding chamber, and dual set of contacts.

B. Approved Manufacturer

1. Notifier #NVR
2. Viking
3. Potter
4. Equal as approved by Architect prior to bidding. See Architectural Section.

2.9 DRAINS

A. Angle type.

2.10 DEVICES AND MATERIALS

A. Provide chrome-plated escutcheon plates where sprinkler piping passes through walls, floors, or ceilings.

B. Hangers, clamps, and seismic braces shall conform to requirements of NFPA 13.

C. Fire Sprinkler Contractor shall provide and install an approved double-check backflow preventer.

2.11 SUBSTITUTIONS

A. Where bid documents do not specify a manufacturer, the contractor may use any material or device that is Underwriters Laboratories listed and/or Factory Mutual approved for its intended use. Where plans specify a material or device, that specific item shall be used. Substitution of piping is acceptable subject to the following conditions:

B. If piping is substituted, the Contractor shall provide new hydraulic calculations, show information on shop drawings which specifically identifies the type of pipe and fittings used, and change the information contained in the hydraulic placards on the shop drawings. Adjusted flow test information shown on bid documents shall be used in re-calculating.

C. Substitution of sprinkler heads and other equipment is acceptable if material substituted is equal to that shown on bid documents, does not adversely affect the design, and is clearly identified on the shop drawings.

PART 3 - EXECUTION

3.1 APPROVALS

A. Obtain all required approvals prior to fabrications or installation of any equipment. Install system in accordance with approved shop drawings.

3.2 INSPECTION

A. Examine areas and conditions under which fire sprinkler system is to be installed and notify General Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.3 FIRE CAULKING

A. Fire sprinkler contractor shall fire caulk all wall penetrations for fire sprinkler piping and equipment per manufacturer's recommendations to meet or exceed fire rating of wall.

3.4 SERVICE ENTRANCE PIPING

A. Fire sprinkling water- service piping from utility main to 5'-0" from building shall be installed or supervised by fire sprinkling.

B. Connect sprinkler piping to water-service piping of size and in location indicated for service entrance to building. Fire Sprinkler Contractor to begin approximately 5'-0 from building exterior.

C. Install underground service entrance piping according to NFPA 13 and with restrained joints.

D. Provide PIV as required by codes or local jurisdiction.

3.5 TESTS

A. Disinfect piping when and as required by local jurisdiction.

B. Perform and pay for all tests required by applicable codes during and after completion of the work and correct any defects in the systems indicated by the tests.

C. Pressure test overhead and underground piping and flush underground piping and document an appropriate test certificate form. All tests shall be witnessed by a representative of the Owner, General Contractor or local jurisdiction and shall be in accordance with NFPA 13.

3.6 CLEANING

A. Remove oil, scale, debris, and foreign substances from inside and exterior of devices, piping, equipment, and materials prior to installation.

B. Upon job completion, remove tools, surplus materials, and equipment, leaving all areas broom clean.

3.7 DEMONSTRATION

A. Sprinkler Contractor shall provide the Owner's representative with general instructions on the operation of the sprinkler system.

B. Sprinkler Contractor shall provide a copy of NFPA 25 to the Owner.

END OF SECTION 211310

NICET CET FINAL INSPECTION FORM

Contractor: _____

_____

Property Inspected: _____

Inspected by: _____
(Name)

_____
(Address) (Telephone)

_____
(CET Number) (Date)

I have personally inspected the building sprinkler system and found it to be complete per the approved drawings and/or the approval comments on the drawings. The enclosed red-lined drawings have been corrected to reflect the approval comments and the following field changes:

During my inspection, a drain test was run with the following results: Static Pressure:

Residual Pressure: _____ (with drain wide open) _____

All areas of the building that were sprinkled and/or modified have been done per NFPA 13 and/or the specific Contract requirements.

The spare head cabinet is complete, all required signs have been posted for the system, and all riser equipment is in the proper working order.

_____

(CET Signature) *(Date)*

SECTION 211310 - FIRE SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section.

B. Requirements of Mechanical General Provisions Sections govern the work specified in this section except that NFPA 13 shall take precedence.

C. Division 21 Section “Fire Alarm Systems” for connection of valves and alarms.

1.2 SUMMARY

A. The extent of the fire sprinkler system design and installation shall meet the requirements of NFPA 13 and meet the requirements as shown on Contract drawings and specifications. The completed system shall include all those items necessary to make the fire sprinkler system complete and operational.

1.3 APPLICABLE CODES

A. NFPA 13

B. Underwriters Laboratories “Fire Protection Equipment Directory”.

C. Factory Mutual Systems “Loss Prevention Data Sheets” where applicable and “Approval Guide”.

D. Applicable local building and fire prevention codes and ordinances.

1.4 SYSTEM DESCRIPTION

A. Fire sprinkler protection for the building shall be complete as defined by NFPA 13 and the local jurisdiction. The extent of fire sprinkler system installation shall be defined to include all those items necessary to make the system complete and operational and is to include but is not necessarily limited to: Approved design and layout drawings, underground supply, supply mains, backflow preventer, sprinkler riser including fire department connection, alarm devices and valves, gauges, control and test valves, pipe hangers, sprinkler heads, seismic bracing, and identification signs. The sprinkler contractor is required to provide complete fire sprinkler protection of the building as defined by NFPA 13 unless otherwise specifically required by these specifications.

1.5 QUALITY ASSURANCE

A. The standards of NFPA 13 shall take precedence.

B. Sprinkler Contractor shall be licensed as a fire sprinkler contractor in the State of Idaho.

C. All materials, devices, and equipment shall be new and shall be Underwriter’s Laboratory listed and/or FM approved for use in fire protection systems.

D. Drawings for sprinkler system design included in the Contract Documents are for reference only. Fire Sprinkler Contractor is responsible for making his own field verification of the job and provide complete design shop drawings with hydraulic calculations prior to fabrication. Make final coordination with other trades and off-set piping and heads, as necessary. Major conflicts shall be brought to the attention of the General Contractor for resolution by the Architect.

E. Data files for drawings may be requested from the Project Architect. A hold-harmless agreement signed by the General Contractor and Sub-contractor will be required before files are released.

F. Do not connect to underground water supply mains provided by others without receiving a copy of the "Contractor's Material and Test Certificate" with certification that all flushing and pressure testing of the mains has been completed. Meet all NFPA 13 requirements and local codes.

G. All materials and equipment specified under this section shall be American manufactured and made.

1.6 SYSTEM DESIGN

A. Sprinkler protection for the building shall be complete as defined by NFPA 13 and local jurisdiction. All design densities, system protection area limitations, and the hydraulically most demanding remote area square footage shall be per NFPA 13, including any combustible ceiling spaces or around any building features which obstruct sprinkler discharge. Any areas subject to freezing shall be protected with a dry system or a propylene glycol anti-freeze system per NFPA 13 and local jurisdiction.

B. The Fire Sprinkler Contractor/CET shall perform a current waterflow test. This test shall be witnessed by or provided by the local authority having jurisdiction. This waterflow test information and date of the test shall be provided along with hydraulic calculations, shown on the design shop drawings.

C. Design density shall be as follows:

1. Light hazard occupancy shall meet a minimum design density of 0.10 over 1500 ft^2.
2. Ordinary hazard, group 1 occupancy shall meet a minimum design density of 0.15 over 1500 ft^2.
3. Ordinary hazard, group 2 occupancy shall meet a minimum design density of 0.20 over 1500 ft^2.

D. Contractor is responsible for coordination of piping and sprinkler head locations with other trades, including any minor offsets as may be required. **Where conflicts occur, they shall be resolved prior to installation. Major conflicts shall be brought to the attention of the General Contractor for resolution** by the Architect. Coordinate system layout so as not to interfere with light fixture arrangement and air outlets.

E. Wiring of waterflow and valve supervisory switches for local alarms and off-premises monitoring is provided for under Division 16 Section "Fire Alarm Systems".

F. Seismic bracing shall be provided as required by NFPA 13.

G. Sprinkler piping shall be concealed above the ceiling where ceilings are present.

H. Provide identification signs for all control, drain, test, and alarm valves. Attach hydraulic criteria placard permanently to the main riser. Where control valves are located in closets or above ceiling, provide appropriate identification sign on closet door or on ceiling.

1.7 SUBMITTALS

A. Shop drawings shall be prepared by a registered Engineer or a fire Sprinkler Senior Engineering Technician (Level III or Level IV) NICET certification shall be provided for the fire sprinkler design. Include NICET certification number on drawings. Drawings will be signed by the Engineer or Technician and submitted for approval under his or her name.

B. No equipment submittals are required. All equipment used in the fire sprinkler system design and installation shall be clearly indicated on the plans, including manufacturers name and model numbers.

C. Prior to fabrication, prepare shop drawings for submittal to the State Fire Marshal or authority having jurisdiction. After review and acceptance by the State Fire Marshal, submit seven (7) sets of approved drawings and hydraulic calculations to the Architect for review and acceptance.

D. Do not proceed with fabrication or installation until all required approvals have been obtained.

E. Upon completion of the system, a fire sprinkler engineer or CET shall document the 2" drain test, inspect the general system installation, and verify that the installation is complete and installed according to the approved drawings and specifications. Minor corrections and/or additions to the drawings shall be red lined on the record drawings. The Contractor shall submit required record drawings, CET form and test certificates to the Contractor for submittal to Owner. In addition, the Contractor shall also submit the following items directly to the Architect:

1. One set of blue line drawings marked As-Builts with appropriate corrections or additions.
2. Copy of Contractors Material and Test Certificates for overhead and underground piping.
3. Copy of CET Final Inspection Form

F. Final payments will not be released until all submittals, as-builts, documentation and certificates have been provided.

PART 2 - PRODUCTS

2.1 PIPING

A. No piping shall be used with a Corrosion Resistance Ratio of less than 1.00.

B. All piping used on dry pipe system shall be Schedule 40 or hot-dipped galvanized.

C. Special pipe such as XL pipe or Lightwall Threadable pipe shall not be used.

D. All piping shall be in conformance with NFPA 13 requirements.

2.2 FITTINGS

A. All fittings shall meet requirements of NFPA 13

B. No plain-end fittings shall be allowed.

2.3 SPRINKLERS

A. Nominal ½" orifice for ordinary temperature classification rating unless other indicated or required by application.

B. Install concealed flush heads with cover, or equal as approved by Architect prior to bid, in occupied areas.

1. Use sprinklers according to the following applications:
    a. Recessed, chrome, pendent sprinklers in public areas.
    b. Upright, brass sprinklers in mechanical and electrical rooms.
    c. Dry pendent in entry vestibules and any other spaces subject to freezing.
    d. Pendant type may be installed in storage rooms, custodial rooms, and in concealed spaces.
    e. Install side wall type in elevator shaft.

C. O-Ring sprinklers are not allowed.

D. All sprinklers shall be installed in a workmanlike manner in respect to ceiling layout with pendent sprinkler heads to be located no less than 6” from edge of ceiling grid.

2.4 DEVICES AND MATERIALS

A. Provide chrome-plated escutcheon plates where sprinkler piping passes through walls, floors, or ceilings.

B. Hangers, clamps, and seismic braces shall conform to requirements of NFPA 13.

C. Fire Sprinkler Contractor shall provide and install an approved double-check backflow preventer.

2.5 SUBSTITUTIONS

A. Where bid documents do not specify a manufacturer, the contractor may use any material or device that is Underwriters Laboratories listed and/or Factory Mutual approved for its intended use. Where plans specify a material or device, that specific item shall be used. Substitution of piping is acceptable subject to the following conditions:

B. If piping is substituted, the Contractor shall provide new hydraulic calculations, show information on shop drawings which specifically identifies the type of pipe and fittings used, and change the information contained in the hydraulic placards on the shop drawings. Adjusted flow test information shown on bid documents shall be used in re-calculating.

C. Substitution of sprinkler heads and other equipment is acceptable if material substituted is equal to that shown on bid documents, does not adversely affect the design, and is clearly identified on the shop drawings.

PART 3 - EXECUTION

3.1 APPROVALS

A. Obtain all required approvals prior to fabrications or installation of any equipment. Install system in accordance with approved shop drawings.

3.2 INSPECTION

A. Examine areas and conditions under which fire sprinkler system is to be installed and notify General Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.3 FIRE CAULKING

A. Fire sprinkler contractor shall fire caulk all wall penetrations for fire sprinkler piping and equipment per manufacturer’s recommendations to meet or exceed fire rating of wall.

3.4 SERVICE ENTRANCE PIPING

A. Fire sprinkling water- service piping from utility main to 5'-0" from building shall be installed or supervised by fire sprinkling.

B. Connect sprinkler piping to water-service piping of size and in location indicated for service entrance to building. Fire Sprinkler Contractor to begin approximately 5'-0 from building exterior.

C. Install underground service entrance piping according to NFPA 13 and with restrained joints.

D. Provide PIV as required by codes or local jurisdiction.

3.5 TESTS

A. Disinfect piping when and as required by local jurisdiction.

B. Perform and pay for all tests required by applicable codes during and after completion of the work and correct any defects in the systems indicated by the tests.

C. Pressure test overhead and underground piping, and flush underground piping, and document on appropriate test certificate forms. All tests shall be witnessed by a representative of the Owner, General Contractor or local jurisdiction and shall be in accordance with NFPA 13.

3.6 CLEANING

A. Remove oil, scale, debris, and foreign substances from inside and exterior of devices, piping, equipment, and materials prior to installation.

B. Upon job completion, remove tools, surplus materials, and equipment, leaving all areas broom clean.

3.7 DEMONSTRATION

A. Sprinkler Contractor shall provide the Owner's representative with general instructions on the operation of the sprinkler system.

B. Sprinkler Contractor shall provide a copy of NFPA 25 to the Owner.

END OF SECTION 211310

NICET CET FINAL INSPECTION FORM

Contractor: _____

_____

Property Inspected: _____

Inspected by: _____
(Name)

_____
(Address) *(Telephone)*

_____
(CET Number) *(Date)*

I have personally inspected the building sprinkler system and found it to be complete per the approved drawings and/or the approval comments on the drawings. The enclosed red-lined drawings have been corrected to reflect the approval comments and the following field changes:

During my inspection, a drain test was run with the following results:

Static Pressure: _____

Residual Pressure: _____ (with drain wide open)

All areas of the building that were sprinkled and/or modified have been done per NFPA 13 and/or the specific Contract requirements.

The spare head cabinet is complete, all required signs have been posted for the system, and all riser equipment is in the proper working order.

_____
(CET Signature) *(Date)*

SECTION 211313 - WET-PIPE AUTOMATIC SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions, Division 01, and Sections 220501 apply to this Section.

B. Division 02 - Criteria for performance of excavation & backfill

C. Section 220000 applies to this section.

1.2 SUMMARY

A. Includes But Not Limited To

1. Furnish and install complete fire sprinkler system as specified in Contract Documents.
2. Perform necessary excavation and backfilling.

1.3 SUBMITTALS

A. Working Drawing Submittal Procedure

1. Submit seven sets of working drawings to Architect and two sets to local Fire Prevention Bureau before submission to underwriters checking agency.
2. After integrating Architect's and local Fire Prevention Bureau comments into drawings, submit drawings to underwriters checking agency and local Fire Prevention Bureau for approval and stamping.
3. After approval, submit four copies of approved, stamped drawings, with calculations, to Architect.
4. Architect retains right to add or relocate heads.

B. Test Reports

1. Furnish Architect with copies of certificates required by testing agencies.
2. All materials and equipment specified under this section shall be American manufactured and made.

1.4 QUALITY CONTROL

A. Qualifications

1. Installer of work of this Section shall be licensed.

B. Requirements of Regulatory Agencies

1. Layout for installation of a wet pipe fire sprinkler system that shall conform to NFPA #13 for Light and Ordinary Hazard, requirements of local Fire and Water Departments, and applicable rules, regulations, laws, and ordinances of local authorities.
2. Upon completion of work of this Section and prior to acceptance, subject system to tests required by underwriter's checking agency and City with representatives of Fire Department present.

3. Test systems including yard piping at 200 psi for two hours with no visible leakage in above ground piping. Make tests at low point in system or zone being tested.
4. Test blanks shall have red painted lugs protruding beyond flange to clearly indicate their presence and be numbered to assure their removal when testing is completed.
5. Install underground piping as recommended by NFPA Pamphlet #24.
6. Examine contract documents (including architectural) carefully, to locate and identify all voids, concealed spaces, and other building characteristics. Make provisions for fire sprinkling these areas, as required by NFPA 13 and other NFPA sections.

PART 2 - PRODUCTS

2.1 PIPE

A. Above Ground

1. Pipe and Fittings: Pipes and fittings 2½" and larger shall meet the requirements of N.F.P.A. Standard #13. Piping 2" and smaller shall be standard wall schedule 40 black steel pipe. Fittings shall be class 150 malleable iron threaded.
2. Victaulic couplings, valves fittings and specialty items may be used in lieu of welded, flanged, or threaded connections. Grade "E" gaskets shall be used up to a maximum operating temperature of 230°F. Where Victaulic system is used, Victaulic S/700, S/703, S/704 butterfly valves and S/715 check valve may be used where accepted by local authorities, insurance underwriters and NFPA standards.
3. Pipe Hangers: All hangers shall be a type approved by the local fire department and installed as per NFPA and local requirement for spacing of hangers and pipe sizes.

B. Below Grade

1. All Areas
   a. Bell and spigot cast iron, AWWA Standard, Class 150 with fittings to match.

2. Outside Building Area
   a. Transite Class 150 Industrial Pressure Pipe with Ring-Tite couplings, AWWA C400-53T. Fittings shall be cast iron pressure fittings with Ring-Tite bells, AWWA C100-55.
   b. If local codes permit, Manville's "Blue Brut" UL labeled PVC pipe and fittings may be used.

2.2 VALVES

A. Valves used with below grade pipe shall be cast iron pressure type.

B. Post Indicator Valves (where required)

1. AWWA and UL listed, with standard indicator post flange and post similar and equal to Kennedy #5412 series with post extensions as required.
2. Approved Manufacturers
   a. Kennedy
   b. Grinnell
   c. Equal as approved by Architect prior to bidding. See Architectural Section.

C. Gate Valve - Butterfly or OS&Y

D. Check Valve - Swing or wafer type.

E. Provide USC listed backflow preventor if required by local water district.

2.3 SPRINKLER HEADS

A. Install recessed heads, or equal as approved by Architect prior to bid, in occupied areas. Pendant type may be installed in Storage Rooms, Custodial Rooms, and in concealed spaces. Install side wall type in elevator shaft.

B. Install wire guards where required for protection.

C. Furnish spare heads of each type and temperature rating used, properly boxed with sprinkler head wrench as required by NFPA 13.2-2.7.

D. Approved Manufacturers

1. Star
2. Grinnell
3. Viking
4. Reliable
5. Equal as approved by Architect prior to bidding. See Architectural Section.

2.4 TRIM

A. Water motor, alarm gong, 10” in diameter.

B. Pressure gauge

C. Testing bypass

D. Escutcheon Plates

1. Chrome or nickel plated and installed on pipes through finished wall, floors, or ceilings.
2. Approved Manufacturers
   a. B&C #10
   b. Equal as approved by Architect prior to bidding. See Architectural Section.

2.5 FIRE DEPARTMENT CONNECTION

A. 4" x 2½", polished brass standpipe mount type with turn down Siamese connection and built in check valve.

2.6 UNDERGROUND VALVE BOXES

A. Concrete box with traffic weight cast iron lid marked for service.

B. Approved Manufacturers

1. Christy
2. Brooks
3. Equal as approved by Architect prior to bidding. See Architectural Section.

2.7 FLOW SWITCH

A. Provide with built-in retard, retarding chamber, and dual set of contacts.

B. Approved Manufacturer

1. Notifier #NVR
2. Viking
3. Potter
4. Equal as approved by Architect prior to bidding. See Architectural Section.

2.8 DRAINS

A. Angle type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not use couplings except where distance between fittings exceeds 20'-0".

B. Use flanged fittings in control valve and drain assembly at base of risers. Where sprinkler system passes through partition, flanged fitting may be provided within partition.

C. Drains

1. Run drains outside building under sidewalk to spill onto paving area at finish grade level.
2. Install main drains on main risers and auxiliary drains at low points in system.
3. Install inspector's test drains as near outer end of system as possible where 1¼” branch line is available.
4. Five or fewer heads on riser will not require drain valve but may be drained through plugged fitting.

D. Alarm Flow Switch

1. Install on supply connection. Connect one set of contacts to alarm bell and other set to remote alarm.
2. Switch shall give signal upon operation of any single sprinkler head.

E. Install sprinklers in overhang where applicable. Exterior lines shall have accessible shut-off valve with separate branch line and freeze protection as required.

F. Install sprinkler lines concealed.

G. Avoid locating sprinklers on ceiling grid lines. Heads shall be located no less than 6" from ceiling grid lines.

H. Locate connection to water service, Fire Department connection detector check valve, and concrete valve pit in landscape area or as indicated on the plans in accordance with Water and Fire Department's requirements. Protect this area with at least four, 6” diameter x 7’ long steel, concrete filled pipes installed 3'-6" into ground.

I. Before connection to sprinkler system, flush underground mains and lead-in connections. Flow shall be at least 390 gpm for 4" pipe, 880 gpm for 6" pipe, 1560 gpm for 8" pipe, 2440 gpm for 10" pipe, and 3520 gpm for 12" pipe. Flow for deluge or hydraulically designed systems shall be at least water demand rate determined by system design. Continue flow until water is clear.

J. After sprinkler installation has been completed, tested, and approved, remove all oil, grease, etc. from piping, heads, fittings, etc. and leave the system in a neat, clean and workmanlike manner.

K. After installation, remove all waste materials, debris, extra piping, etc. resulting from system installation. Dispose of debris legally.

L. Instruct the owner and/or his representative in the proper maintenance and operation of the fire sprinkler system using NFPA 25 as a guide.

M. Provide a written warranty for workmanship and materials for a period of one year from the date of final acceptance of the installation. Repair and replacement of items shall be made without cost to the owner during the warranty period.

N. As the work progresses, record all changes on a set of drawings kept at the job site. At the completion of the work furnish one corrected set of reproducible drawings to the engineer as record drawings.

END OF SECTION 211313

SECTION 211316 - DRY-PIPE AUTOMATIC SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions, Division 01, and Sections 220501 apply to this Section.

B. Division 02 - Criteria for excavation and backfilling.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install complete fire sprinkler system as described in Contract Documents.
2. Provide working drawings and calculations for fire sprinkler system.
3. Perform necessary excavation and backfilling.

1.3 SUBMITTALS

A. Working Drawing Submittal Procedure

1. Submit seven sets of working drawings to Architect and two sets to local Fire Prevention Bureau before submission to underwriters checking agency.
2. After integrating Architect's and local Fire Prevention Bureau comments into drawings, submit drawings to underwriters checking agency and local Fire Prevention Bureau for approval and stamping.
3. After approval, submit four copies of approved, stamped drawings, with calculations, to Architect.
4. Architect retains right to add or relocate heads.

B. Test Reports

1. Furnish Architect with copies of certificates required by testing agencies.

1.4 QUALITY ASSURANCE

A. Qualifications

1. Installer performing work of this Section shall be licensed in accordance with local requirements.
2. All materials and equipment specified under this section shall be American manufactured and made.

B. Requirements of Regulatory Agencies

1. Layout and system shall conform to NFPA13, requirements of local Fire and Water Departments, and applicable rules, regulations, laws, and ordinances of local authorities.
2. Upon completion of work of this Section and prior to acceptance, subject system to tests required by underwriter's checking agency and City with representatives of Fire Department present.

3. Test systems including yard piping at 200 psi for two hours with no visible leakage in above ground piping. Make tests at low point in system or zone being tested.
4. Test blanks shall have red painted lugs protruding beyond flange to clearly indicate their presence and be numbered to assure their removal when testing is completed.
5. Install underground piping as recommended by NFPA Pamphlet 24.
6. Examine contract documents (including architectural) carefully, to locate and identify all voids, concealed spaces, and other building characteristics. Make provisions for fire sprinkling these areas, as required by NFPA13 and other NFPA Sections.

1.5 MAINTENANCE

A. Extra Materials

1. Furnish spare heads of each type and temperature rating used, properly boxed with sprinkler head wrench as required by NFPA 13 2-2.7.

PART 2 - PRODUCTS

2.1 PIPE

A. Above Ground

1. Pipe and Fittings: Pipes and fittings 2½" and larger shall meet the requirements of N.F.P.A. Standard 13. Piping 2" and smaller shall be standard wall schedule 40 black steel pipe. Fittings shall be class 150 malleable iron threaded.
2. Victaulic couplings, valves fittings and specialty items may be used in lieu of welded, flanged, or threaded connections. Grade "E" gaskets shall be used up to a maximum operating temperature of 230°F. Where Victaulic system is used, Victaulic S/700, S/703, S/704 butterfly valves and S/715 check valve may be used where accepted by local authorities, insurance underwriters and NFPA standards.
3. Pipe Hangers: All hangers shall be a type approved by the local fire department.

B. Below Grade

1. All Areas
   a. Bell and spigot cast iron, AWWA Standard, Class 150 with fittings to match.

2. Outside Building Area
   a. Transite Class 150 Industrial Pressure Pipe with Ring-Tite couplings, AWWA C400-53T. Fittings shall be cast iron pressure fittings with Ring-Tite bells, AWWA C100-55.
   b. If local codes permit, Manville's "Blue Brut" UL labeled PVC pipe and fittings may be used.

2.2 VALVES

A. Valves used with below grade pipe shall be cast iron pressure type.

B. Post Indicator Valves (where required)

1. AWWA and UL listed, with standard indicator post flange and post similar and equal to Kennedy #5412 series with post extensions as required.

2. Approved Manufacturers
    a. Kennedy
    b. Grinnell
    c. Equal as approved by Architect prior to bidding. See Architectural Section.

C. Gate Valve - Butterfly or OS&Y

D. Check Valve - Swing or wafer type.

E. Provide USC listed backflow preventor if required by local water district.

F. Dry Pipe Valve - Air actuated. Compressed air by Plant Air Compressor.

2.3 SPRINKLER HEADS

A. Install recessed heads, or equal, as approved by architect prior to bid, in occupied areas. Pendant type may be installed in storage rooms, custodial rooms, and in concealed areas.

B. Install wire guards where required for protection.

C. Approved Manufacturers

1. Star
2. Grinnell
3. Viking
4. Reliable
5. Central
6. Equal as approved by Architect prior to bidding. See Architectural Section.

2.4 TRIM

A. Water motor, alarm gong, 10” diameter.

B. Pressure gauge

C. Testing bypass

D. Escutcheon Plates

1. Chrome or nickel plated and installed on pipes through finished wall, floors, or ceilings.
2. Approved Manufacturers
    a. B&C #10
    b. Equal as approved by Architect prior to bidding.

2.5 FIRE DEPARTMENT CONNECTION

A. 4" x 2½", polished brass standpipe mount type with turn down Siamese connection and built in check valve.

2.6 UNDERGROUND VALVE BOXES

A. Concrete box with traffic weight cast iron lid marked for service.

B. Approved Manufacturers

1. Christy
2. Brooks
3. Equal as approved by Architect prior to bidding.

2.7 FLOW SWITCH

A. Provide with built-in retard, retarding chamber, and dual set of contacts.

B. Approved Manufacturers

1. Notifier #NVR
2. Potter
3. Viking
4. Equal as approved by Architect prior to bidding.

2.8 DRAINS

A. Angle type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not use couplings except where distance between fittings exceeds 20' 0".

B. Use flanged fittings in control valve and drain assembly at base of risers. Where sprinkler system passes through a partition, a flanged fitting may be provided within the partition.

C. Drains

1. Run drains outside building under sidewalk to spill onto paving area at finish grade level.
2. Install main drains on main risers and auxiliary drains at low points in system.
3. Install inspector's test drains as near outer end of system as possible where 1¼" branch line is available.
4. Five or fewer heads on a riser will not require a drain valve but may be drained through a plugged fitting.

D. Alarm Flow Switch

1. Install on supply connection. Connect one set of contacts to alarm bell and other set to remote alarm.
2. Switch shall give signal upon operation of any single sprinkler head.

E. Install sprinklers in overhang where applicable. Exterior lines shall have accessible shut-off valve with separate branch line and freeze protection as required.

F. Install sprinkler lines concealed.

G. Avoid locating sprinklers on ceiling grid lines. Head shall be located no less than 6" from ceiling grid lines.

H. Locate connection to water service, Fire Department connection detector check valve, and concrete valve pit in landscape area or as indicated on the plans in accordance with Water and Fire Department's requirements. Protect this area with at least four, 6” diameter x 7’ long steel, concrete filled pipes installed 3'-6" into ground.

I. Before connection to sprinkler system, flush underground mains and lead-in connections. Flow shall be 750 gpm minimum for 6” pipe, 1000 gpm for 8” pipe, 1500 gpm for 10” pipe, and 2000 gpm for 12” pipe. Flow for deluge or hydraulically designed systems shall be at least water demand rate determined by system design. Continue flow until water is clear.

J. Install branch lines and mains with proper slope to main or auxiliary drains in accordance with NFPA13.

K. Make connection to house air compressor in the mechanical room.

L. After sprinkler installation has been completed, tested, and approved, remove all oil, grease, etc. from piping, heads, fittings, etc. and leave the system in a neat, clean and workmanlike manner.

M. After installation, remove all waste materials, debris, extra piping, etc. resulting from system installation. Dispose of debris legally.

N. Instruct the owner and/or his representative in the proper maintenance and operation of the fire sprinkler system using NFPA25 as a guide.

O. Provide a written warranty for workmanship and materials for a period of one year from the date of final acceptance of the installation. Repair and replacement of items shall be made without cost to the owner during the warranty period.

P. As the work progresses, record all changes on a set of drawings kept at the job site. At the completion of the work furnish one corrected set of reproducible drawings to the engineer as record drawings.

END OF SECTION 211316

SECTION 220501 - COMMON PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Related Sections: Refer to "Electrical Requirements for Plumbing Equipment" Division 26 for basic electrical requirements, for all Mechanical equipment in Division 23. Special and specific electrical requirements are specified within each respective equipment specification section.

1.2 SCOPE OF WORK - GENERAL

A. This section specifies the basic requirements for plumbing installations and includes requirements common to Section 220000. It expands and supplements the requirements specified in sections of Division 01 General Requirements.

B. The work covered by the Plumbing Sections of the Specifications shall include the furnishing of all materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of all mechanical work required in the Contract Drawings.

C. It is the intent of the Contract Documents to provide an installation that is complete and operable in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, it shall be the responsibility of the Contractor to provide all material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

D. The Contractor shall review all Contract Drawings (Plumbing and HVAC) and Specifications and include in his bid all work specifically as being performed in the Plumbing section. The Contractor shall be responsible for all work performed by his subcontractors.

1.3 DEFINITIONS

A. "Provide" shall mean "furnish and install complete and ready for intended use."

B. "Indicated" shall mean "indicated on drawings" and/or the intent for a complete and operable system.

C. "Concealed" shall mean "hidden from sight as in trenches, chases, furred spaces or hung ceilings.

D. "Exposed" shall mean "not concealed", as defined above.

E. "Noted" shall mean "noted on Plumbing and HVAC drawings or in specifications".

F. "Contractor" also referred to as "Plumbing Contractor" or "the Contractor", shall mean "the Plumbing Contractor".

1.4 CODES AND STANDARDS

A. All plumbing work shall be installed in strict accordance with the most current edition of the International Building Code (IBC) or International Plumbing Code, International Mechanical Code (IMC), Uniform Plumbing Code (UPC), National Fire Protection Association (NFPA), International Fire Code (IFC), National Electrical Code (NEC), Energy Code IECC and ASHRAE-90.1, and all applicable state and local codes, laws and ordinances that relate to the work to be accomplished.

1.5 PERMITS AND FEES

A. The Contractor shall obtain and pay for all required permits and fees necessary to fully complete all work included in the Contract Drawings and Specifications.

1.6 CONSTRUCTION OBSERVATIONS:

A. During the course of construction of this project, the engineer shall visit the project site periodically on an as-needed basis. The construction observation intervals may vary depending on the progress and/or stage of construction and whether sewer, vents, water, natural gas, air, Domestic cold and hot water for drains, and overflows, condensate piping, etc., is being placed below grade and/or concealed, surface mounted items, setting of equipment, equipment connections, etc. However, written field questions are encouraged and welcomed throughout the course of construction and shall be answered promptly in writing, to keep the project construction on schedule. The project foreman should have the building plans, construction schedules, etc., affixed in mind, so the plumbing systems defined in the construction documents are to be assembled, along with the setting of equipment, of parts and pieces, related to the project are anticipated, to prevent delays or emergencies.

B. The engineer shall make one (1) final inspection. The contractor shall notify the engineer that the installation is complete, i.e., the systems are operating and have been tested and balanced, and everything is complete and operational, all equipment connections have been made and the owner's representatives have been trained. At this time the engineer, the contractor, and the owner's representative shall schedule a time to walk the project for evaluation, and record in writing the items found to be incomplete. The contractor shall make the corrections within one week after this inspection. If at the conclusion of the observation tour the owner and engineer determine that additional visits are required to complete the project, **the contractor shall reimburse the engineer at the rate of $600 for each site visit required, plus out of pocket expenses, until all items are acceptable to the engineer and owner. The contractor shall pay the engineer in advance of each inspection.**

C. On extra visits, the contractor shall report to the engineer that all systems are complete, and the project is ready for the owner's acceptance.

1.7 INTENT AND INTERPRETATION

A. The Drawings and Specifications are intended to supplement each other, and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. The drawings are partly diagrammatic and do not necessarily show the exact location of all new piping and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of the equipment. They shall not be used for obtaining quantities or lineal runs of piping.

D. The location of all piping shall be checked to determine that it clears all openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.

E. Plumbing drawings shall serve as the working drawings for this portion of the work, but the Contractor shall refer to the Architectural, Structural, HVAC, and Electrical drawings for additional detail affecting the installation of his work. Architectural drawings shall take precedence over the Plumbing drawings if any dimensional discrepancies exist.

F. The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the approval of the Architect, who reserves the right to make any reasonable changes in the locations indicated without additional cost.

G. The contractor shall not make a change in a system, system layout, and/or equipment, except he receives written approval or drawing over the signature of the engineer.

1.8 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 General Requirements for submittal definitions, requirements, and procedures.

B. SHOP DRAWINGS AND PRODUCT DATA OF EQUIPMENT BEING INSTALLED IN THE PROJECT: After the contract is awarded, but prior to manufacture or installation of any equipment, the contractor shall assemble and submit Shop Drawings, parts lists, Brochures, etc., for the materials and equipment requiring approval for each section of this specification. A brief description of submittal conditions is given below. Refer to identified sections for detailed submittal requirements.

C. Confirming and approving substitute equipment for the project.

1. Confirm that the substitute equipment is approved for installation before entering it into the base bid. It must be defined as to name, catalog number or both in a published addendum. **If not approved, do not enter in the base bid**.
2. Each unit shall state the name of the equipment manufacturer (name, address, phone, email, etc.) catalog number, size, physical dimensions and weight, energy characteristics (electrical and/or fuel), operating characteristics, materials from which constructed, any special conditions that may apply to the construction of the unit, etc.
3. The equipment must explain and define in detail the components that make-up the unit, so the owner and engineer can determine, define the replaceable parts during the life of the unit.
4. Complete operating instruction, normal maintenance recommendations, start-up procedures, etc.
5. In general, the contractor shall acquaint himself with the equipment to confirm that it can be installed as shown on the plans and from his experience perform the indicated function in the system where installed.

6. In the course of reviewing the shop drawings, **the Contractor shall confirm the energy usage** (gas, power, air, water, drains, physical size, weight etc.) and determine if these services are available at the equipment characteristics. Namely: confirm voltage, phase, etc., with the project's electrical characteristics. Availability of fuels with the serving utility, also drains, water (hot and cold) pipe sizes, etc., or if there are discrepancies in the services. If the indicated equipment services are not available, inform the engineer by phone and in writing, also note on the shop drawing. This cooperative effort will correct a problem before the equipment arrives at the job site.
   a. The shop drawings shall also indicate the scheduled delivery dates the equipment will be at the site.
   b. If the contractor foresees any problems with equipment size, weight, delivery, etc., it shall be noted in writing, attached to the shop drawings.

1.9 RECORD DOCUMENTS

A. Contractor shall record differences between plumbing systems as installed and those indicated in Contract Documents on a set of prints of plumbing drawings to be furnished by Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 General Requirements.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall prepare and submit Operation and Maintenance Manuals for mechanical systems provided under this Contract. Comply with Division 1 requirements for procedures and requirements for preparation and submittal of manuals.

B. Manual binder shall have permanent lettering of a contrasting color. Information to be included on the binder is as follows:

Enter binder information below

C. The front cover shall be lettered as follows:

PLUMBING
OPERATION AND MAINTENANCE
MANUAL
(PROJECT NAME)
(CITY AND STATE)
(YEAR)

OWNER:	(*NAME)*
ARCHITECT:	*(NAME)*
PLUMBING ENGINEER:	Nielson Engineering Inc.
GENERAL CONTRACTOR:	*(NAME)*
PLUMBING CONTRACTOR:	*(NAME)*

The spine shall be lettered as follows:

PLUMBING O & M MANUAL (*Year)*
(Project Name)

D. Provide a master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.

E. Cover section shall consist of name, address, and phone number of Project Architect, General Contractor, Mechanical Engineer, Mechanical Contractor, and all Mechanical Sub-Contractors.

F. Provide a separate section for each section of the specifications. Provide index for each section listing equipment included. Include all items specified in Sections 220529 through 226313. Provide a list of each type of equipment supplied with the local supplier's name, address, and phone number.

G. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be original. Copies are not acceptable.

H. One (1) copy of the manual shall be submitted for review and approval by the Engineer. After approval, submit three (3) copies of manual to the Owner for approval unless otherwise directed by Division 1 requirements. Information to be included in manual:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine, and normal operating instructions; regulation, control, stopping shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Schematic control diagrams (as built status) for each automatic control system. Mark correct operating setting for each control instrument on these diagrams. A second complete set of control diagrams encased in clear plastic laminate shall be furnished.
6. Valve schedule indicating the valve symbol (tag number), valve location by room number and description, valve purpose and system served, and valve size. Provide one corresponding set of full-size mechanical prints (as-builts status) showing these valve locations for cross-reference. A second complete set of valve schedules (8½" x 11") encased in clear plastic laminate and fitted in an aluminum holding frame shall be furnished to the Owner.
7. Testing, Adjusting and Balancing Report.
8. Test records and certifications.
9. Instruction period checklist.
10. Warranty information.

1.11 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. The Contractor shall instruct the Owner's Representative(s) in the Operation and Maintenance procedures described in the Operation and Maintenance Manual. Comply with Division 1 requirements.

B. Individuals present shall include Contractors, Subcontractors, and equipment factory representatives. These individuals shall assist in instruction and start-up.

C. Minimum instruction time shall be eight (8) hours unless otherwise specifically noted.

D. All Plumbing systems shall be properly functioning prior to instruction period.

E. Contractor shall prepare a checklist of all equipment and systems requiring instruction and maintenance for verification by the Owner's Representative of satisfactory start-up and instruction. A copy of this checklist shall be included in the Operation and Maintenance Manual.

1.12 GUARANTEE

A. Contractor shall guarantee the satisfactory operation of all material and equipment installed under section 220000 and shall repair or replace to the satisfaction of the Owner or Architect, any defective materials, equipment, or workmanship which may show itself within one year from the date of acceptance.

1.13 CLEANING

A. The Contractor shall, at all times, keep the premises free from accumulations of waste material or rubbish.

B. At completion of the job, the Contractor shall remove all tools, scaffolding, and surplus materials.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. All materials, in general, shall conform to the requirements of all agencies or publications specified and described in Division 01 of the Contract Specifications.

B. Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

C. All plumbing fixtures, pipes, fittings, and materials specified shall comply with the certification of ‘Buy America’ compliance for manufactured products.

2.2 SUBSTITUTIONS AND APPROVAL OF PRODUCT OPTIONS

A. Substitute equipment is encouraged if it is truly an equal to the specified items

1. The items and/or equipment specified in the contract documents are standard manufacturers items found in suppliers’ catalogs, except it be indicated as special. The designer has taken time and effort to analyze, evaluate and prove to himself that the specified units will perform the function needed, wherein it is placed. This means the responsibility for the function of the specified equipment rests with the designer, who knows and understands what is to be accomplished.

2. If a **supplier** and/or the **contractor** desire to substitute equipment in place of a specified item, he may do so, but he takes upon himself or herself the **full responsibility** that the substituted equipment will equal all of the performing characteristics, functions, etc., and/or exceed the performance of the specified item. The substitute equipment shall be of such a physical size and weight that it will mount in the designated location without alterations to the building and the structure will carry the load. If for any reason the substituted equipment requires alterations or modification, in any form to the building and/or the structure, the costs shall be paid by the contractor and/or those requesting the substitutions.
3. Those interested in requesting a substitution shall submit a substitution request. The **substitution request will be considered if it is at the office of the Engineer eight (8) working days prior to the day of bidding. The request shall include the following:**
   a. **A statement certifying that the equipment proposed is equal to that specified; that it has the same mechanical operating characteristics, compatible dimensions, weight, electrical characteristics and meets the function and intent of the equipment named in the contract documents.**
   b. **The specification and catalog numbers of the substituted equipment.**
   c. **A pictorial and specification brochure.**

4. Because of the short bidding period, (from issuance of drawing to bid date), between the substitution request and the bid date, the designer does not have adequate time to make a full evaluation of substitute equipment. Therefore, **those requesting the substitution** must accept **full responsibility** for the items being submitted for substitution (operating characteristics, physical size, weight, output, not increase the load, etc.). If at any time during the course of construction, **even up into the final completion**, if the designer finds the equipment does not meet the design criteria, comply with the performance, etc., **those requesting the substitution and the contractor have the responsibility to remove the substituted equipment and install the specified item at their expense.** There shall be no cost assessed to the owner and/or the designer and **the replacement will not delay the completion of the project.**

B. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents, nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer, who will issue interpretation and/or additional instructions to Bidders before the project is bid.

C. Any conflict arising from the use of **substituted equipment shall be the responsibility of the contractor,** who shall bear all costs required to make the equipment comply with the intent of the contract documents.

D. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

E. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued. This substitution may be made by a change order.

F. Substitute equipment shall not be bid except it is formally issued on a **Project Addendum**.

PART 3 - EXECUTION

3.1 COORDINATION AND WORKMANSHIP

A. The Contractor shall at all times cooperate with other trades on the job to avoid friction and delay to the progress of work. All points in dispute shall be referred to the Architect.

3.2 SUPERVISION

A. This Contractor shall have in charge of the work at all times a thoroughly competent superintendent. Comply with Division 01 requirements.

3.3 WORKMANSHIP

A. The work under the plumbing contract shall be performed by Journeyman workers skilled in the particular trade and include all work necessary to properly complete the installation in a professional manner so as to present a neat and finished appearance.

3.4 EXAMINATION OF SITE

A. The Contractor shall visit the site of the proposed work and become familiar with the conditions affecting the work. Contractor shall verify all measurements at the building before beginning work.

3.5 SITE UTILITY SERVICES

A. Where applicable, the Contractor shall make connections to existing permanent cold water service immediately so as to provide the use of this service by other trades. Comply with Division 01 and 02 requirements.

If not remodel remove

3.6 EXISTING UTILITIES AND PIPING

A. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a 10' radius of the indicated locations. Where connection points are not within this radius, the Contractor shall contact the Architect for a decision before proceeding or may proceed at his own expense.

B. Existing piping (hot and cold water), vent lines, drain lines, roof drains, etc., that are found to obstruct the construction area (walls, floors and ceilings) and obstruct the removal of a wall, doorway or passageway, etc., shall be rerouted and/or relocated to clear the construction. The cost for this work shall be included as a part of the project and shall be covered in the contractor's base bid.

C. If systems of other trades or exhaust ducts fall within or obstruct construction area for whatever reason, the contractor shall relocate these items to allow construction to proceed. The cost for this work shall be included as a part of the base bid.

D. Existing extensions: piping (water, drain, vent, air, etc.), etc., that are noted to be extended and/or retrofit (for whatever reason) to accommodate added and/or new areas or facilities shall accomplish the intent for which the system was designed. When complete, the system and/or systems shall function as if they were new. This work shall be included in the base bid for the project.

E. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including, but not limited to removal of plumbing piping, plumbing fixtures and trim, and other plumbing items made obsolete by the new work.

Note: The specifications identify each system herein mentioned and the extension and additions shall adhere to the specifications defined for this phase of construction.

3.7 LAYING OUT WORK

A. Locations of all equipment shown on the drawings, is approximate unless dimensioned. Exact locations of such items shall be determined by the Architect's representative and/or secured from special details and drawings. Verify the physical dimensions of each item of plumbing equipment to fit the available space and promptly notify the Architect/Engineer prior to roughing-in if conflicts appear. Coordination of equipment to the available space and to the access routes through the construction shall be the Contractor's responsibility.

B. The contractor **shall hand deliver to the general contractor** a written statement and/or a manufacturer’s brochure on the equipment being installed at each location. The information shall give the dimensions and weight (loads) of each unit being installed. The general contractor shall forward a copy of this information to the structural engineer and obtain from him confirmation that the building structure will accommodate the loads. If there be any problem the questioning party shall notify the mechanical engineer by phone and in writing.

3.8 CONTRACTOR COORDINATION

A. In the course of installing the systems defined in the contract documents, the contractor shall closely follow the plans, details and specifications (contract documents). The system design has been a careful and laborious undertaking, with the intent purpose of producing a system and/or systems that will serve the owner well with a minimum of maintenance. Thence, the contractor shall adhere as closely as possible to the plans, details, and specifications for each system. Questions and suggestions are encouraged as the project is being assembled. If for any reason, the contractor feels to deviate from the defined information, and finds a way, to improve the system, to make the system more easily assembled, make it operate more efficiently, etc., the contractor shall suggest the change to the engineer. Systems are designed to perform a specific function; the most minute change in assembly may change the function. If the engineer agrees with the change, he will authorize the contractor to proceed. Contractor cooperation and coordination is appreciated. If the contractor proceeds on construction without the designer’s authorization, it shall be reworked, in accordance to plans and specifications, which work shall be at the contractor’s expense.

B. The contractor shall coordinate his construction. These systems, location of equipment, connections of services, etc. with the architectural, HVAC sector 230000, electrical 260000 documents throughout the course of construction. If problems are unsolvable contact the design engineer.

3.9 CUTTING AND PATCHING

A. All cutting and patching of new or existing construction required for installation of Plumbing systems and equipment specified in Section 220000 shall be the responsibility of the Plumbing Contractor unless otherwise noted. Comply with Division 01 for general requirements for cutting and patching.

B. All cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. All patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of plumbing installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of plumbing equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.

G. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineer observation of concealed work.

H. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.10 EXCAVATION AND BACKFILL

A. Contractor shall provide all necessary excavation, shoring, and backfilling required for proper installation of plumbing work inside and outside the building. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to ½ the depth of the excavation, but in no instance closer than 2'. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of in designated areas approved for surplus material storage. Grading shall be done as necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained.

B. Trenches shall be excavated to depth indicated or required to establish indicated slope and invert elevations and to support bottom of piping or conduit on undisturbed soil. Trenches shall be of uniform width, sufficient to provide ample working room and a minimum of 6 to 9" of clearance on both sides of pipe or conduit.

C. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3" or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing. Where unyielding material is encountered in the bottom of the trench, such material shall be removed 6" below the required grade and replaced with materials described below for bedding.

D. Excavation for manholes, catch basins, inlets, or similar structures shall be sufficient to leave at least 12” clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

E. Bedding material shall be clean, sand-gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D 422.

U.S. Standard	Percent Passing Sieve Size
1”	100
No. 4	25-80
No. 200	0-10

F. Bedding material shall be placed to a depth of 6" over the top of piping. The bedding shall be brought up evenly on both sides of the pipe for the full length of the pipe.

G. Backfill for the remainder of the trench shall be satisfactory soil materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

H. Backfill soil materials shall be free of clay, rock or gravel larger than 2” in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

I. Backfill to the required grade shall be placed in lifts not exceeding 6” loose thickness for compaction with hand operated machine compactors, and 8” loose thickness for other than hand operated machines otherwise specified. Each layer shall be compacted to density 105% of the adjacent soil density or as stated in the soil compaction section of these documents.

J. No underground lines shall be covered until the installation has been approved by the inspector having jurisdiction and the Owner's Representative.

K. Provide 4” thick concrete base slab support for piping less than 2' - 6" below surface of roadways. After installation and testing of piping, provide minimum 4” thick encasements (sides and top) of concrete prior to backfilling or placement of roadway subbase.

L. Bracing and shoring shall be provided where depth of excavation or character of ground render it necessary for personnel protection. Shoring shall be constructed of heavy timber planking with timber supports and shall conform with local and state safety laws and regulations.

M. Removal of bracing and shoring materials shall be done before backfilling except where necessary to insure against caving; in which case, it shall be withdrawn while backfilling is being done.

N. Provide barricades around all excavation. Barricades to be securely constructed.

O. The Contractor shall exercise extreme care while excavating in the area of utilities, carefully check for location of all possible utilities, whether shown on the drawings or not, and establish the location of all cutoff valves for ready shut-off of service in case of emergency. The Contractor shall be completely responsible for all damage to any utilities caused in excavating as well as damage to personnel and property caused by said damaged utilities whether shown on the drawings or not.

3.11 REPLACEMENT OF PAVING AND CONCRETE

A. All existing or new sidewalks, concrete paving, curbs, or asphalt paving removed or damaged by this Contractor during the period of the installation or as a result thereof, shall be replaced with like material in a manner as directed by and to the satisfaction of the Owner's Representative. Comply with Division 02 General Requirements.

3.12 OPENINGS IN PIPES

A. All temporary openings in pipes shall be capped or sealed during construction. Caps shall be removed for final connections.

3.13 PROTECTION OF MATERIALS AND EQUIPMENT

A. Contractor shall be held responsible for any and all materials and equipment to be installed under this contract and will be required to make good at his own cost any injury or damage which materials or equipment may sustain from any source or cause whatsoever before final acceptance. Comply with Division 1 requirements.

3.14 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of plumbing materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.15 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Access doors or hatches required for servicing of mechanical equipment shall be furnished and installed as specified in the other Sections of the Specifications.

3.16 PAINTING

A. The contractor shall paint all natural gas lines exposed to the elements with 2 coats, one coat of primer and one coat of paint, yellow oil base enamel and likewise all other piping as indicated.

B. Contractor shall touch-up scratched, or damaged factory finishes of Plumbing equipment. Comply with Division 01 requirements.

C. Unless otherwise noted, all other painting of plumbing related items shall be according to Section 09900 "PAINTING".

3.17 LUBRICATION

A. Contractor shall properly lubricate all pieces of equipment before turning the building over to the Owner. Comply with Division 01 requirements.

3.18 FINAL CLEANING

A. Refer to Division 1 for general requirements for final cleaning.

B. At time of final cleanup, all fixtures and equipment shall be thoroughly cleaned and left in condition for use. All stickers, tags, shipping labels, and Manufacturers' labels shall be removed.

3.19 FIRE PENETRATION SEALS

A. All penetrations through fire rated floors and walls shall be sealed to prevent the spread of smoke, fire, toxic gas, or water through the penetration either before, during or after a fire. The fire rating of the penetration seal shall be at least that of the floor to wall into which it is installed so that the original fire rating of the floor or wall is maintained.

B. The sealant shall remain soft and pliable to allow for the removal and/or addition of piping without the necessity of drilling holes. It shall adhere to itself to allow any and all repairs to be made with the same material. It shall permit the vibration, expansion and/or contraction of piping and ducts going through the penetration without the seal cracking or crumbling.

C. When damming materials are to be left in place after the seal is complete, all such materials shall be non-flammable.

D. When sealant is injected into a penetration, the foam shall expand to surround all items within the penetration and maintain pressure against the walls of the penetration. Excess foam shall be removed. The foam shall cure within five minutes and be fire resistant at that time. No heat shall be required to further expand the foam to block the passage of fire and smoke or water.

E. All wall or floor penetration openings shall be as small as possible.

F. The foam sealant shall meet all of the fire test and hose stream test requirements of ASTM E119-73 and shall be UL classified as a Wall Opening Protective Device. The sealant shall be CHASE-FOAM, CTC PR-855 Fire Resistant Foam Sealant from Chase Technology Corporation, Huntington Station, New York 11746 or 3M Brand Fire Barrier caulk CP25, putty 303, wrap/strip FS 195 or sheet CS 195 from 3M Products Divisions, 224-4N 3M Center, St. Paul, MN 55144-1000.

3.20 TESTING, ADJUSTING, AND BALANCING

A. The plumbing systems shall be pressure tested in strict accordance with local and state codes by Journeyman with five plumber's years' experience in pressure testing. The report shall be stamped by a licensed certified plumber. The Balancing water flows in and to all equipment shall be instruments for making tests and performing work. The Plumbing Contractor shall include in his base bid all costs for tests and Balancing.

B. Testing of piping systems shall not be made until the code conditions are satisfied.

C. All instruments used for measurements shall be accurate and calibration histories for each instrument shall be available for examination. The Mechanical Engineer has the right to request instrument recalibration, or the use of other instruments, where accuracy of readings is questionable.

D. Furnish in the report a written guarantee to be effective for one year from the date of acceptance, to make any and all adjustments required to maintain comfort in all rooms and areas.

E. Reports

1. Upon completion of testing, adjusting, and balancing of the water systems, prepare a complete and legible draft report. Submit two (2) copies of the draft report to the Plumbing Design Engineer for review.
2. Upon verification and approval of the draft reports, prepare final reports. Four (4) typewritten, organized and formatted copies of the final report are required. Furnish one (1) copy to the Mechanical Design Engineer for his record, and the remaining three (3) copies are to be included in the Owner's Operation and Maintenance Manuals.

FINAL CLEANING

END OF SECTION 220501

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions section 01 and Section 220501 apply to this section.

B. Types of pipe and fittings as specified under each section.

1.2 SUMMARY

A. Included but not limited to

1. All domestic water lines (hot, cold, return, service, etc.) being installed under the contract documents. Gas piping soil, waste, and vent condensate.

1.3 QUALITY INSURANCE

A. Rigid pipe hangers shall carry 5 times the load. See details on the plans.

1.4 PRODUCTS

A. Adjustable, malleable iron device type of a diameter adequate to support the pipe size see schedules below.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Hangers, Rods, and Inserts:

1. Black or Iron Galvanized or UL approved for service intended.
2. Hangers and accessories shall be Grinnell numbers specified or equals by B-Line.
   a. Support horizontal piping from clevis hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on drawings. Hangers shall have double nuts.
   b. Support insulated pipes with clevis hanger equal to Grinnell Fig 260 or roller assembly equal to Grinnell Fig 171 with an insulation protection shield equal to Grinnell Fig 167. Gauge and length of shield shall be according to Grinnell design data.
   c. Support uninsulated copper pipe from Grinnell Fig CT-65 copper plated hangers and clevis hanger equal to CT-65 is Clevis Hanger, CT-97 Adjustable Ring.

3. Support spacing shall be per IPC and UPC.

4. Support rods for single pipe.

Rod Diameter	Pipe Size
3/8″	2″ and smaller
½″	2-1/2 to 3-1/2″
5/8″	4 to 5″
¾″	6″
7/8″	8 to 12″

5. Support rods for multiple pipe supported on steel angle trapeze hangers:

Rods		Number of Pipes Carried, of Sizes Listed						
Number	Diameter	2″	2-1/2″	3″	4″	5″	6″	8″
2	3/8″	2	--	--	--	--	--	--
2	½”	3	3	2	--	--	--	--
2	5/8″	6	4	3	2	--	--	--
2	¾″	9	7	5	3	2	2	--
2	7/8″	12	9	7	5	3	2	2

6. Size trapeze angles so bending stress is less than 10,000 psi.
7. Riser clamps for vertical piping: Grinnell Figure 261.
8. Concrete Inserts
   a. Grinnell Figure 282
   b. Suitable for special nuts size 3/8” through 7/8” with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
   c. Continuous inserts shall be Unistrut P-3200 series.

9. Steel deck bracket: Unistrut P1000 with clamp nut, 6”h length minimum.

2.2 MANUFACTURERS

A. Contact Information

1. B-Line Systems, Highland, IL www.blind.com
2. EPCO Products Inc, Fort Wayne, IN www.epcoproducts.com
3. Globe Pipe Hanger Products Inc, Cleveland, OH www.globepipehanger.com
4. Grinnell Corp, Lansdale, PA www.grinnell.com
5. Michigan Hanger Company, Niles, OH (800) 333-0852 or (330) 544-4700.
6. Superstrut by Thomas & Betts, Memphis, TN www.tnb.com
7. Victaulic Company of America, Easton, PA or Victaulic Company of Canada, Rexdale, ON www.victaulic.com
8. Watts Regulator Co, North Andover, MA www.wattsreg.com

END OF SECTION 220529

SECTION 220548 - VIBRATION SUPPORTS AND SEISMIC RESTRAINTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions Division 01 and Section 220501 apply to this section.

B. Section 033000 Cast-In-Place Concrete

C. Furnishing and installing of seismic restraint and vibration isolation systems is by installer of equipment requiring such systems. Manufacturers of equipment specified for seismic restraint equipment requiring such systems. Manufacturers of equipment dimensions, dimensioned anchor points, operating weight, and center of gravity dimension.

1.2 SUMMARY

A. Includes but not limited to

1. Quality of and requirements for anchorage and seismic restraint systems and vibration isolation systems for plumbing piping and equipment.

1.3 REFERENCES

A. American Society for Testing and Materials

1. ASTM A 615-04b, 'Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement'.

B. Sheet Metal and Air Conditioning Contractors National Association/American National Standards Institute.

1. SMACNA/ANSI 001-2000, ' Seismic Restraint Manual: Guidelines for mechanical Systems'.

1.4 SUBMITTALS

A. Product Data

1. Restraint system and anchorage method to be used for each piece of equipment.
2. Seismic restraints and calculations for all flexible mounted equipment.
3. Vibration isolators and flexible couplings.
4. Clearly outlined procedures for installing and adjusting isolators, seismic bracing anchors, and snubbers.

B. Shop Drawings

1. Show size, hanger length, and location of seismic restraints for piping and ductwork.
2. Show details for each isolator and seismic brace with snubbers proposed for specified equipment.
3. Show details for proposed structural steel frames and rails and for anchors to be used in conjunction with isolation of equipment.

4. Show locations of piping and ductwork restraints on installation and fabrication floor plans (not bid set of documents of floor plans), noting size and type of restraint to be used.
5. Show details of supports, hangers, anchorage, and bracing for isolated equipment as designed or proposed by professional engineer employed by a Restraint Manufacturer and qualified with seismic experience in bracing for mechanical equipment. Shop drawings submitted for seismic bracing and anchors shall bear engineer's signed professional seal.
6. Include anchor bolt calculations, signed and stamped by registered engineer, showing adequacy of bolt sizing and type.
    a. Calculations shall include anchor embedment, minimum edge distance and minimum center distance.
    b. Design lateral forces shall be distributed in proportion to mass distribution of equipment.
    c. Furnish calculations for anchors on restraint devices, cable, isolators, and on rigidly mounted equipment.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: System design and installation shall meet seismic requirements as defined in 2009 Edition of International Building Code, Section 1621 and applicable state and local codes in accordance with the site's Seismic Zone and with the minimum restraint capability of [.33] or [.5] g. Explicit requirements and details can be found in referenced SMACNA Manual.

B. Seismic Requirements: Plumbing equipment and piping shall be braced, snubbed, or supported to withstand seismic disturbances and remain operational.

C. Vibration Isolation Requirements: Isolate equipment from structure by means of resilient vibration and noise isolators.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Isolation and Seismic Equipment:

1. Piping: Restrain piping in accordance with Figures 4.11 to 4.19 in SMACNA Manual.
2. Equipment with Fixed Anchor or Support:
    a. Restraint designed according to Sections 1621 and 1622 of International Building Code.
    b. Horizontal force factor for elements of structures:
        1) In addition, vertical force restraint requirement shall be computed at ½ value of horizontal forces.
        2) Restrain equipment not anchored directly to floors by cable system designed and furnished by Restraint Manufacturer.

B. Vibration Isolation Requirements:

1. Design and install isolation equipment, hangers, connections, and other isolating devices to prevent transmission of vibration to structure from equipment and associated piping.
2. For floor-mounted equipment, use recommendations of ASHRE 2003 Table 45.

3. For roofs and floors constructed with open web joints, thin long span slabs, wooden construction and unusual light weight construction, evaluate equipment weighing more than 300 pounds to determine additional deflection of structure caused by equipment weight. Isolator deflection shall be 15 times additional deflection or deflection shown in Table 45, whichever is greater.
4. Under-Equipment Spring Isolators:
    a. Equal to Mason SSLFH earthquake motion restrained spring mounts with freestanding stable steel springs, leveling bolts, corrosion resistant finish, motion limiting design, uplift restraining bolts, and ¼" ribbed neoprene noise stop pad.
    b. Isolators shall accept force in any direction up to 1.0g without failure and shall limit movement to ¾" in any direction.
    c. Springs shall have 50% overload capacity.
    d. Size as required to achieve specified static deflection.
    e. Outer diameter of spring proper shall not be less than 0.8 of spring height when in loaded position.

5. Overhead Support Spring and Rubber Hangers:
    a. Combination spring and neoprene hangers.
    b. Hanger bracket shall have 500% overload capability and shall allow up to 15º hanger rod misalignment without short-circuiting.
    c. Springs shall have 50% overload capacity.
    d. Provide seismic bracing as required.

6. Isolate piping in mechanical equipment rooms and piping three supports away or 50' from other mechanical equipment, whichever is greater, form structure by means of vibration and noise isolators.
    a. Isolate suspended piping with combination spring and fiberglass hangers in supporting rods.
    b. Support floor-mounted piping directly on spring mounts.

7. Isolate vertical pipe risers from structure using vibration and noise isolating expansion hangers having minimum rated deflection of four times anticipated pipe movement. Enclose in housing for fail-safe equipment.
8. Incorporate flexible connectors in piping adjacent to reciprocating equipment.
9. Elastomeric Isolator: Neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives.
10. Nuts, Bolts, and Washers: Electroplated zinc.
11. Isolators Exposed to Weather: Cadmium plated and neoprene coated springs.

C. Seismic restraint equipment and resilient isolation devices shall be designed and furnished by single Manufacturer.

D. Type One Acceptable Manufacturers:

1. Amber/Booth Company, Houston, TX www.amberbooth.com.
2. Mason Industries Inc, Hauppauge, NY www.mason-ind.com.
3. Vibration Mountings and Control Inc, Bloomington, NJ (201) 838-1780.
4. Equal as approved by Architect before bidding. See Section 01 6000.

2.2 FINISHES

A. Clean and paint steel components. Thoroughly clean structural steel bases of welding slag and prime with zinc-chromate or metal etching primer. Etch and paint hot dipped galvanized steel components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Isolation Equipment:

1. Mount vibration isolated equipment on rigid steel frames or concrete bases unless Equipment Manufacturer certifies direct attachment capability.
2. Install snubbers with factory set clearances.
3. Piping:
    a. Protect isolated and non-isolated piping 2½" inside diameter and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motions.
    b. Locations shall be as scheduled and include, but not be limited to:
        1) At drops to equipment and at flexible connections.
        2) At 45º or greater changes in direction of pipe.
        3) At horizontal runs of pipe 30' maximum on center spacing.
        4) Gas piping shall have additional restraints as scheduled.

B. Vibration Isolation: Install piping to prevent transmission of noise and vibration into structure.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPES AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install identification of equipment and piping as described in Contract Documents.

PART 2 - PRODUCTS

2.1 PAINT

A. Benjamin Moore Impervo or equivalent by Paint Manufacturer approved in Architectural Painting Sections.

B. Use appropriate primer.

2.2 LABELS

A. 1/8" Laminated Black Formica with white reveal on engraving. Value tags, brass with black lettering.

B. 1½" Brass valve tags with black lettered numbers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Stenciling

1. Locate identifying legends and directional arrows at following points on each piping system
   a. Adjacent to each item of equipment and special fitting.
   b. At point of entry and exit where piping goes through wall.
   c. On each riser and junction.
   d. Every 50’ on long continuous lines.

2. Domestic Hot & Cold Water Piping Identification
   a. Identify domestic hot and cold water piping above and below ceilings with stenciled letters "HW" and "CW" respectively.
   b. Letters shall be 1” high. Provide "Direction of Flow" arrow at each stencil.
   c. Paint color shall be as specified below.

B. Painting: All pipe painting shall be provided for by the installing contractor i.e.: plumbing by the Plumbing Contractor.

1. All piping in Mechanical room shall be painted.
2. Paint natural gas piping outside the mechanical room.
3. All piping label, inside and outside mechanical room.

C. Identification shall comply with, but not limited to the following:

PIPE PAINTING AND LABELING LEGEND

SERVICE & LABEL	SYMBOL	LABEL COLOR* BACKGROUND	LETTER	PIPE COLOR**
DOMESTIC COLD WATER	DCW	GREEN	WHITE	DARK ROYAL BLUE
DOMESTIC HOT WATER	DHW	YELLOW	BLACK	MAGENTA
DOM. HOT WATER RETURN	DHWR	YELLOW	BLACK	MAGENTA
SOFT COLD WATER	DSW	GREEN	WHITE	DARK ROYAL BLUE
RAINWATER	RW	GREEN	WHITE	BROWN
SANITARY SEWER	SAN	GREEN	WHITE	BROWN
NATURAL GAS	G	YELLOW	BLACK	DARK GREEN

* Ref. ANSI codes 13.1 (1981). See Specs.
** Exposed piping in mechanical rooms, boiler rooms, etc., shall be painted color indicated on chart.

D. SIZE OF LETTERS AND LENGTH OF FIELD

OD OF PIPE OR COVERING	SIZE OF LETTERS	LENGTH OF COLOR FIELD
¾" To 1½"	½"	8"
1½" To 2"	¾"	8"
2 ½" To 6"	1¼"	12"
8" To 10"	2½"	24"
Over 10"	3½"	32"

E. Paint Specification: All surfaces to be painted shall be prepared in accordance with the detailed painting specifications in the Painting Section of these specifications. Surfaces that are not subjected to temperatures higher than 212º F shall be painted as specified for the area in which they are located. Pipes, valves, or other equipment subjected to temperature above 212º F, shall be painted with heat resisting black enamel or heat resisting aluminum paint as specified below. The Owner's Representative shall designate surfaces to be painted aluminum painted at least three coats. Colors shall be selected by Owner's Representative.

F. Heat resisting black enamel shall be Sta-Black as manufactured by Pratt and Lambert Co., or Ebonite Boiler and Stack Paint as manufactured by W.P. Fuller Co. or approved equal suitable for use at temperatures of at least 45°F.

END OF SECTION 220553

SECTION 220600 - SCHEDULES FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. The fixtures and equipment shown in the schedules are a part of this project and shall be included. Items in the schedules may or may not be found in the specifications but shall be included in the base bid.

B. The items stated in the schedule identify a quality of product and all substitutions shall be of that same quality.

C. If the named items have a delay in availability, notify the engineer immediately for a decision or an alternative.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. The specified equipment shall be supplied and shall include the base unit with all the parts and pieces to install it into the system where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The scheduled items shall be installed in strict accordance with the manufacturers' recommendations and the details on the plans. If the details conflict in any way with the manufacturer's recommendations contact the engineer.

B. The installation shall not void the equipment warranty for any reason.

END OF SECTION 220600

SECTION 220700 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to -

1. General piping installation procedures for all piping systems.

B. Related Sections -

1. General Conditions, Division 01, and Section 230501 apply to this Section.
2. Type of pipe and fittings specified under each piping system.

1.2 QUALITY ASSURANCE

A. Manufacturer -

1. Use domestic (USA) made pipe and pipe fittings on Project.

PART 2 - PRODUCTS

2.1 VALVES

A. Valves of same type shall be of same manufacturer.

B. Valves shall be domestic (USA) on this project.

2.2 PIPE HANGERS

A. Adjustable, malleable iron clevis type of a diameter adequate to support pipe size.

B. Approved Manufacturers -

1. B-Line Systems Fig. B3100
2. Grinnell No. 260
3. Kin-Line 455
4. Superstrut CL-710

2.3 INSULATING COUPLINGS

A. Suitable for at least 175 PSIG WP at 250°F.

B. Approved Manufacturers -

1. Central Plastics Co
2. Victaulic Co
3. Watts Regulator Co

2.4 SLEEVES

A. Sleeves shall be standard weight galvanized iron pipe, Schedule 40 PVC, or 14 gauge galvanized sheet metal two sizes larger than pipe or insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.

B. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.

1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
2. Do not use pipe hooks, chains, or perforated metal for pipe support.
3. Remove burr and cutting slag from pipes. All pipe and tube shall be reamed to the full inside diameter of the pipe and tube.
4. Make changes in direction with proper fittings.
5. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
6. Support piping at 8’ on center maximum for pipe 1¼” or larger and 6’ on center maximum for pipe 1” or less. Provide support at each elbow. Install additional support as required.
7. Suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps (except underground pipe). Laying of piping on any building member is not allowed.

C. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings. Provide accessible, ground joint unions in piping at connections to equipment.

D. Make connections of dissimilar metals with insulating couplings.

E. Provide sleeves around pipes passing through floors, walls, partitions, or structural members.

1. Seal sleeves with plastic or other acceptable material.
2. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

F. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

G. Install piping systems so they may be easily drained.

H. Grade soil and waste lines within building perimeter ¼" fall per ft in direction of flow or as noted on the plans.

I. Insulate water piping buried within building perimeter.

J. Do not use reducing bushings, street elbows, or close nipples.

K. Bury water piping 6" minimum below bottom of slab and encase all water lines in PVC or ABS sleeves, a minimum of 2 pipe sizes larger than water line being encased and the insulation installed on this piping. Install 2" minimum of sand around the encasement pipe.

END OF SECTION 220700

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install insulation on:
   a. Above ground hot water, hot water return and cold water lines, fittings, valves, and accessories as described in Contract Documents.
   b. Underground piping
   c. Roof drain piping, water piping and fittings.
   d. Overflow drain and condensate piping and fittings.

B. Related Sections

1. General Conditions, Division 01, that apply to this Section.

PART 2 - PRODUCTS

2.1 INSULATION

A. On domestic water (Above grade):

Cold Water	½" - 2"	½" Thick
	2" - Greater	1" Thick
Hot Water	½" - 1"	1½" Thick
	1¼" - 2"	1½" Thick
	2" – Greater	2" Thick
Roof & Overflow	2" - 4"	1" Thick
	5" - 7"	1" Thick

With factory vapor jacket.

B. Below grade joints shall be sealed with category four products ½" thick for 1" to 2" pipe and 1" for 2" and larger snap-on closed cell polyolefin or elastomeric pipe insulation.

1. Armacell 5200
2. Rubatex R373
3. Armstrong Armaflex

C. Approved Manufacturers

1. Manville
2. Owens-Corning
3. Knauf
4. IMCOA "ImcoLock"
5. Armstrong "Armaflex"

2.2 PVC FITTING, VALVE, & ACCESSORY COVERS

A. Approved Manufacturers

1. Knauf
2. Zeston

PART 3 - EXECUTION

3.1 APPLICATION

A. Piping

1. The insulation must be continuous, even through supports (at supports install a split PVC pipe to cover insulation then clamp the split PVC to the support).
2. Apply insulation to clean, dry piping with joints tightly butted.
3. Adhere "factory applied vapor barrier jacket lap" smoothly and securely at longitudinal laps with a white vapor barrier adhesive.
4. Adhere 3” wide self-sealing butt joint strips over end joints.
5. All joints and insulation ends shall be sealed in accordance with the manufacturers and industry practices.

B. Fittings, Valves, & Accessories

1. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
2. Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
3. Alternate Method
   a. Insulate fittings, valves, and accessories with 1” of insulating cement and vapor seal with two 1/8” wet coats of vapor barrier mastic reinforced with glass fabric extending 2” onto adjacent insulation.

C. Pipe Hangers

1. Do not allow pipes to come in contact with the support hangers.
2. Provide 16 ga x 6” long galvanized or PVC split shield over the insulation at each pipe hanger to protect pipe insulation from crushing by clevis hanger.

D. No insulation shall be applied until piping has been pressure tested and approved.

E. In Cold Attic Situations:

1. In all cold attic situations where the building insulation is located at the ceiling, all piping installed in the ceiling to roof space shall be insulated as specified herein.
2. In addition, install at 6" thick by 30" wide fiberglass blanket with vapor barrier (vapor barrier towards warm side of cavity) over the pipe to tent and allow heat loss through the ceiling to prevent the pipe from freezing. The insulation blanket shall be held in place by rolling it on a wood lathe and nailed to the joist. The building insulation shall then be applied over this pipe protection insulation.

F. Underground insulation shall be covered by slipping the insulation onto the pipe and sealing the butt joints. If slip-on is not possible, cut the insulation, install, then seal the seams and joints.

1. Insulation
    a. ½" thick Armaflex standard pipe insulation.
    b. Equals by Rubatex or IMCOA "Imcolock"
    c. All joints shall be sealed with Armstrong 520

G. In room installations where excess moisture or humidity will be present or when insulation is exposed in occupied spaces (from finished floor level to 10'-0" or ceiling height) (examples: kitchen, water lines, gym roof drain line, science rooms, stairways, hallways, etc.), provide and install a PVC or Aluminum pipe covering over fiberglass pipe insulation and seal this covering.

END OF SECTION 220719

SECTION 220800 - COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. Before the Plumbing Contractor Commissions the system, he shall confirm the systems has been installed as shown and detailed on the plans; that all fittings are in place and installed as recommended by the manufacturer. He shall also confirm that the piping has been anchored as per the contract documents, and that all code conditions have been met. He shall also know that:

1. All pressure lines shall be complete, supported, insulated and code tested and approved.
2. All Waste and Vent lines are secured in place and have been code tested and approved.
3. All server lines, drains, clean-outs, etc. are complete and likewise have been tested as per code.
4. The test reports shall have been submitted to the architect/engineer over the signature of the inspecting authority.
5. The specified insulation shall have been installed in accordance with the contract documents, manufacturer's recommendations and industry practices.
6. All piping shall have been cleaned of foreign debris, the domestic water lines sterilized in accordance with the specifications and current regulations have been adhered to.
7. The plumbing contractor, shall by his own admission, indicate the project is complete, charged for operation and ready for use.
8. Where equipment testing and/or start-up is indicated to be by a factory representative, this shall be completed. Report time of factory testing to the engineer 10-days prior to the test that he might be present.

PART 2 - TRAINING

2.1 The owner's representative and/or representatives shall be trained on the use and operation of each system.

A. This shall not only include operation of each system, but include routine and annual maintenance required to extend the system longevity.

1. Replacement of seals, gaskets, etc.
2. Cleaning of filters, strainers, etc.
3. Anticipate life of regulators, seats, etc.

END OF SECTION 220800

SECTION 220900 - INSTRUMENTATION AND CONTROL OF PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. The contractor shall provide and install all of the regulations, controls, etc. as not in the contract documents.

B. The contractor shall provide and install a liquid filled or dry as stated on drawings, pressure gauge upstream and downstream from the pressure regulator and at other locations as noted on the plans. These gauges shall be installed in the system with shut-off valves so they may be removed from the system without a system shut down. The dial size shall be listed on drawings.

1.3 TYPES OF GAUGES

A. The gauges shall be as manufactured by

1. Trerice
2. Ashcraft
3. Swagelok
4. Weiss

1.4 EXECUTION

A. The regulators and controls shall be installed in strict accordance with the manufacturers' recommendations.

B. Each gauge shall be installed not more than 3" from the main line and shall have a ball type shut-off valve to isolate it from the line being tested.

END OF SECTION 220900

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions, Division 01, and Sections 220501, 230000 and 260000 as they apply to this Section.

B. Section 221116 Domestic water piping from a point 5’ outside the building unless noted to the service main.

C. Section 220501-3.1 Criteria for performance of excavation and backfill.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install culinary water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines 5’ from building perimeter.
2. Perform excavating and backfilling compactors required by work of this Section.

1.3 SUBMITTALS

A. Quality Control

1. Submit written report of sterilization test to Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURING

A. All pipe and fittings shall be domestic (USA) manufactured.

B. All valves shall be domestic (USA) manufactured.

2.1 PIPE

A. Type K copper for piping underground or beneath concrete slab. ¾” minimum under slabs. Trap primer supplies shall be ½”.

B. Type L hard drawn copper for above ground applications.

C. Wirsbo Aquapex Tubing & Manifold. (Engel Method Extrusion Process).

D. Viego Pureflow PEX tubing and Manabloc

E. Raupex Pipe

2.2 FITTINGS

A. Wrought copper.

B. ProPEX fittings.

C. PEX Press fittings

D. Everlock+fittings

2.3 CONNECTIONS

A. Sweat copper type with 95/5 or 96/4 Tin-Antimony solder.

B. Joints under slabs, if allowed by local codes, shall be brazed.

2.4 BALL VALVES

A. Use ball valves exclusively unless otherwise specified. Ball valves shall be by single manufacturer from approved list below. Valves shall be for 150 PSI SWP.

B. Approved Manufacturers

1. Nibco-Scott T595 or S595 or equal by
2. ConBraCo (Apollo)
3. Crane
4. Hammond
5. Stockham
6. Watts

2.5 STOP & WASTE VALVES

A. Approved Manufacturers

1. Mark II Oriseal stop & waste valve H15134 by Mueller
2. Buffalo screw type curb box H-10350 complete with lid and H-10349 enlarged base by Mueller.

2.6 BACKFLOW PROTECTIONS

A. Approved Manufacturers-

1. Watts No. 909 or No. 009AQ - R.P. Backflow Preventer.
2. FEBCO Model No. 825 or Model No. 880 - R.P. Backflow Preventer.
3. Wilkins Model No. 550 - R.P. Backflow Preventer.
4. ConBraCo.

2.7 COMBINATION PRESSURE REDUCING VALVE/STRAINER

A. Integral stainless steel strainer, or separate 'Y' strainer installed upstream of pressure reducing valve.

B. Built-in thermal expansion bypass check valve.

C. Approved Manufacturers

1. Watts U5B or equal by
2. Cash Valve
3. Spencer
4. Wilkins

2.8 INSULATING COUPLINGS

A. Suitable for at least 175 PSIG WP at 250° F.

B. Approved Manufacturers -

1. Central Plastics Co
2. Victaulic Co
3. Watts Regulator Co

2.9 SLEEVES

A. Sleeves shall be standard weight galvanized iron pipe, Schedule 40 PVC, or 14 gauge galvanized sheet metal two sizes larger than pipe or insulation.

2.10 MIXING VALVES

A. For 110° F 45° C Service.

1. Water inlets with stop valves, check valves, and removable strainers.
2. Water outlet with volume control valve and direct reading dial thermometer.
3. Flow: 1 GPM with maximum 5 psi pressure drop.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping under slabs without joints where possible.

B. Locate cold water lines a minimum of 6” from hot water line.

C. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.

D. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.

1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
2. Do not use pipe hooks, chains, or perforated metal for pipe support.
3. Remove burr and cutting slag from pipes. All pipe and tube shall be reamed to the full inside diameter of the pipe and tube.
4. Make changes in direction with proper fittings.

5. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
6. Support piping at 8’ on center maximum for pipe 1¼” or larger and 6’ on center maximum for pipe 1” or less. Provide support at each elbow. Install additional support as required.
7. Suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps (except underground pipe). Laying of piping on any building member is not allowed.

E. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings. Provide accessible, ground joint unions in piping at connections to equipment.

F. Make connections of dissimilar metals with insulating couplings.

G. Provide sleeves around pipes passing through floors, walls, partitions, or structural members.

1. Seal sleeves with plastic or other acceptable material.
2. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

H. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

I. Install piping systems so they may be easily drained.

J. Grade soil and waste lines within building perimeter ¼” fall per ft in direction of flow or as noted on the plans.

K. Insulate water piping buried within building perimeter.

L. Do not use reducing bushings, street elbows, or close nipples.

M. Bury water piping 6” minimum below bottom of slab and encase all water lines in PVC or ABS sleeves, a minimum of 2 pipe sizes larger than water line being encased and the insulation installed on this piping. Install 2” minimum of sand around the encasement pipe.

3.2 FIELD QUALITY CONTROL

A. Before pipes are covered, test systems in presence of Architect at 100 psi hydrostatic pressure for two hours and show no leaks.

B. Sterilize domestic water system with solution containing 250 parts per million minimum of available chlorine. Introduce chlorinating materials into system in manner approved by Architect. Allow sterilization solution to remain for 24 hours and open and close valves and faucets several times during that time.

C. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.

D. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install items specified in this Section and/or described in Contract Documents.
2. All pipe, fittings, and valves shall be domestic (USA) manufactured.

PART 2 - PRODUCTS

2.1 FLOW CONTROL FITTINGS

A. Vandal proof type and fit faucet spout of fixture used. Flow shall be controlled as required by local codes.

2.2 CONDENSATE DRAINS

A. Provide Type M copper for condensate drains from air handling units, fan coil units, furnace coils, and cooler/freezers. Support piping and protect from damage.

B. Provide schedule 40 PVC for condensate from high tech furnaces, boiler, and water heater.

C. Install 3” deep seal, vented water trap adjacent to coil connection.

D. If condensing equipment is installed without a clarifier, the condensate lines shall be PVC pipe and fitting. Secure all piping.

2.3 CONDENSATE PUMP

A. Rated at 225 gph at 15’ total head. Complete with one gallon polystyrene tank with pump and automatic float control. 1/5 hp, 120 volt, one phase, 60 Hertz.

B. Condensate piping shall be Type M copper.

C. Approved Manufacturers

1. Little Giant #VCL-45ULS

2.4 PRESSURE GAUGES

A. Cast aluminum case

B. Chrome plated ring

C. Clear glass window

D. Phosphor bronze alloy steel bourdon tube

E. ½% scale range accuracy

F. 4½" diameter dial face

G. Range 0 to 100 psig.

H. Liquid Filled.

I. Approved Manufacturers

1. Trerice
2. Swagelok
3. Weiss
4. Ashcraft

2.5 BRASS GAUGE COCKS

A. Approved Manufacturers

1. Ashcroft
2. Weiss
3. Trerice
4. Swagelok

2.6 WATER HAMMER ARRESTERS

A. Provide and install a water hammer arrester at each hot and cold water connection and battery of fixtures.

B. Water hammer arresters shall be sized in accordance with PDI WH-201, precharged, suitable for operation in temperature range 100 to 300º F, and maximum 250 psig working pressure.

C. Water hammer arrestors shall be constructed of stainless steel.

D. Approved Manufacturers:

1. Josam
2. Wade
3. Zurn
4. J.R. Smith

PART 3 - EXECUTION

3.1 INSTALLATION

A. Connect gauges to pipe with ¼" connections ball valve.

END OF SECTION 221119

SECTION 221313 - FACILITY SANITARY SEWER OUTSIDE BUILDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions section 01 and section 230501 and 220553 apply to this section.

B. Section 220501-3.1 Criteria for performance of excavation and backfill.

1.2 SUMMARY

A. Includes But Not Limited To

1. Furnish and install a storm drain piping system from a point 5’ outside the building to a sewer main as shown on the plans.
2. Perform excavation and backfill required by work of this Section.
3. The pipe shall be laid on virgin soil or compacted fill grade to the slope indicated on the plans and/or as directed by local code.

PART 2 - PRODUCTS

2.1 BURIED LINES

A. Service weight, single-hub type cast iron soil pipe and fittings meeting requirements of ASTM A 74-87, "Specification for Cast Iron Soil Pipe & Fittings".

B. Plastic pipe conforming to IAPMO and ASTM specifications will be acceptable where permitted by local code. Installation shall conform to the manufacturers recommendations.

C. Service weight no-hub, cast iron soil pipe or as approved by local code.

D. Joint Material

1. Bell & Spigot Pipe - 50% oakum and 50% lead, well calked, or rubber gaskets meeting requirements of ASTM C 564-88, "Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings".
2. Rubber gaskets meeting requirements of ASTM C 564-88, "Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings".
3. No-Hub Pipe - Neoprene gaskets with stainless steel cinch bands.
4. As recommended by the pipe manufacturer of plastic pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not calk threaded work, all piping must be solid, which will be installed in a soil hub fitting.

B. Slope horizontal pipe at ¼”/ft or, 1/8”/ft, or as shown on plans. Must be in compliance with all local codes.

C. Place cleanouts as follows

1. Where shown on Drawings and near bottom of each stack and riser.
2. At every 90º change of direction for horizontal lines.
3. Every 100’ of horizontal run.
4. Extend cleanout to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.
5. All cleanout to grade and floor cleanouts shall be nickel bronze tops unless otherwise stated on drawings.

3.2 FIELD QUALITY CONTROL

A. Before piping is covered, conduct tests for leaks and defective work. Notify Architect/Engineer prior to testing. Correct leaks and defective work. Fill roof drain system to roof level with water, 10’ minimum, and show no leaks for two hours.

END OF SECTION 221313

SECTION 221316 - FACILITY SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

B. Section 220501-3.1 Criteria for performance of excavation and backfill.

C. Section 221313 Sewage piping from 5’ out from building to main.

D. Section 022200 and 221322 Storm Drain piping.

E. Section 221313-3.1-G Installing of Copper roof jacks.

F. Section 221313-3.1-G2Furnishing and installing of lead roof jacks.

G. Section 078400 Quality Fire Stop Material.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5’ out from building where applicable.
2. ASTA Testing and Material Standards No. 74, 564, 891, 2235, 2231, 2321, etc.
3. Perform excavation and backfill required by work of this Section.

B. Products furnished but not installed under this section

1. All roof flashings.
2. Verify with roofing contractor for type of roof flashing to match roofing material and warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURING

A. All pipe and fittings shall be domestic (USA) manufactured.

2.2 BURIED LINES

A. Service weight, single-hub type cast iron soil pipe and fittings meeting requirements of ASTM A 74-87, "Specification for Cast Iron Soil Pipe & Fittings".

B. Plastic pipe conforming to IAPMO and ASTM specifications will be acceptable where permitted by local code (ABS or PVC schedule 40 pipe).

C. Service Weight, no-hub, cast iron soil pipe or as approved by local code.

D. Joint Material

1. 50% oakum and 50% lead, well calked.
2. Rubber gaskets meeting requirements of ASTM C 564-88, "Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings".
3. No-Hub Pipe- Neoprene gaskets with stainless steel cinch bands
4. As recommended by the pipe manufacturer of plastic pipe.

2.3 ABOVE GRADE PIPING & VENT LINES

A. Same as specified for buried lines except schedule 40 or Galvanized steel piping may be used above grade.

B. Vent lines 2½" or smaller may be Schedule 40 galvanized steel.

C. All ABS or PVC lines and fittings above finished grade shall be insulated for noise abatement.

D. Plastic pipe conforming to IAPMO and ASTM specifications will be acceptable where permitted by local codes.

E. Joint Material

1. Bell & Spigot Pipe - 50% oakum and 50% lead, well calked, or rubber gaskets meeting requirements of ASTM C 564-88, "Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings".
2. No-Hub Pipe - Neoprene gaskets with stainless steel cinch bands.
3. Galvanized Pipe - Screwed Durham tarred drainage fittings.
4. Cleaning (Primers) and solvent cement (GWE) shall be installed as per manufacturer's recommendations.
5. ABS or PVC - Glued fitting as per manufacturer's recommendations.

2.4 BURIED AND ABOVE GRADE ACID WASTE AND VENT LINES

A. Schedule 40 polypropylene acid waste pipe, manufactured to dimensions and tolerances of ASTM F 1412. The pipe shall be fire retardant polypropylene material conforming to ASTM D4101.

B. Fitting shall be schedule 40 polypropylene, manufactured to dimensions as per ASTM F1412. The polypropylene material shall be fire retardant and conform to ASTM D4101.

C. Joining methods between the pipe and fittings shall be mechanical joint, meeting ASTM F 1412 or electrofusion to produce a hermetically sealed joint, conforming to ASTM 1290.

D. All acid waste lines and fittings above floor shall be insulated for noise abatement.

E. Approved products

1. Zurn
2. Orion

2.5 ABOVE GRADE ACID WASTE AND VENT LINES LOCATED IN PLENUM OR FIRE RATED ROOM OR STRUCTURE.

A. Schedule 40 polyvinylidene Fluoride (PVDF) acid waste pipe, manufactured to dimensions and tolerances of ASTM F1672. The pipe shall be fire resistant Polyvinylidene Fluoride material conforming to ASTM D3222.

B. Fitting shall be schedule 40 polyvinylidene Fluoride, manufactured to dimension per ASTM F1673. The polyvinylidene Fluoride (PVDF) material shall be fire resistant and conform to ASTM D3311 and F1673.

C. Joining method between the pipe and fittings shall be mechanical joint, meeting ASTM F1673.

D. Approved products

1. Zurn
2. Orion

E. All acid waste lines and fittings shall be insulated with an approved insulation that meets the flame smoke rating for plenum or fire rated rooms or structure. If necessary the insulation shall be wrapped with a plenum rated tape.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not calk threaded work, all piping must be solid, which will be installed in soil and hub fittings.

B. Slope horizontal pipe at ¼”/ft.

C. Place cleanouts as follows

1. Where shown on Drawings and near bottom of each stack and riser.
2. At every 90º change of direction for horizontal lines.
3. Every 100’ of horizontal run.
4. Extend cleanout to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.
5. Meet all code requirements for cleanouts.
6. All cleanout to grade and floor cleanouts shall be nickel bronze tops unless otherwise stated on the drawings.

D. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have seal trap in connection with complete venting system so gasses pass freely to atmosphere with no pressure or syphon condition on water seal.

E. Vent entire waste system to atmosphere. Discharge 14” above roof. Join lines together in fewest practicable number before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley.

F. Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

*** Roof systems other than concrete roof tile ***

G. Vent pipes passing through the roof are to have a roof flashing, fitted snugly around pipes and calk between flashing and pipe with flexible waterproof compound. Flashing base shall be at least 24 in². Coordinate with roofing contractor to match flashing to roofing materials.

1. Consult roofing contractor for exact type of flashings. Coordinate with the engineer and the roofing contractor for this information.

H. Refer to section 220529 for hangers and support of this piping.

3.2 FIELD QUALITY CONTROL

A. **Before piping is covered, conduct tests for leaks and defective work.** Notify Architect prior to testing. Correct leaks and defective work. Fill waste and vent system to roof level with water, 10′ minimum, and show no leaks for two hours.

END OF SECTION 221316

SECTION 221320 - FACILITY NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

1.2 SUMMARY

A. The gas contractor shall provide and install the gas piping (Natural Gas) from the point of service (outlet of gas meter) to the last piece of gas equipment being served, as shown on the plans.

B. The gas piping shall be supported as outlined in Section 220529.

C. Coordinate the piping with the serving utility. The gas contractor shall provide under this contract all the valves, connection components, etc. required to connect all the gas equipment.

D. If metered the gas utility shall provide the gas service lines the meter (Natural Gas), with the connections being made there to.

E. If the meter requires a base or protection from traffic, the gas contractor shall so provide.

1.3 QUALITY ASSURANCE

A. Qualifications

1. Welders shall be certified and bear evidence of certification 30 days prior to commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

PART 2 - PRODUCTS

2.1 MANUFACTURING

A. All pipe and fittings shall be domestic (USA) manufactured.

B. All valves shall be domestic (USA) manufactured.

2.1 FOR PIPING AND INSTALLATION SEE SECTIONS

A. Meet requirements of ASTM A 53-89a, "Specification for Pipe, Steel, Black & Hot-Dipped Zinc-Coated Welded & Seamless".

B. Carbon steel, butt welded, Schedule 40 black steel pipe.

2.2 FITTINGS

A. Black Pipe

1. Welded forged steel fittings meeting requirements of ASTM A 234-89a, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures", or standard weight 150 lbs, malleable iron screwed.

2.3 VALVES

A. 125 psi bronze body ball valve, UL listed

B. Approved Manufacturers & Models

1. ConBraCo - "Apollo" series 80-100
2. Jenkins - FIG-30-A
3. Jomar - Model T-204
4. McDonald - 3410
5. PGL Corp - "Red Cap" gas ball valve
6. Watts - Model B-6000-UL

2.4 EARTHQUAKE ACTUATED GAS SHUT-OFF VALVES

A. Aluminum Body Valve.

B. Stainless Steel Ball Shut-off.

C. Manual reset.

D. V.L., IAPMO, and A.6.A listed.

E. Approved Manufacturers:

1. Safe-T-Quake.
2. Koso
3. Quakemaster.

F. Gas Pressure Regulators

1. Equimeter
2. Fisher
3. Pietro Fiorentini-Governor

PART 3 - EXECUTION

3.1 FOR INSTALLATION ABOVE AND BELOW GRADE SEE SECTIONS

A. Pipe installed underground, through air plenums, in walls, and pipes 2½" and larger shall be welded pipe and fittings. Other pipe may have screwed or welded fittings.

B. Wrap and lay underground pipe in accordance with local gas utility company regulations and specifications.

C. Install gas cocks on lines serving boilers, furnaces, duct heaters, and water heaters adjacent to boiler, furnace, or heater on outside of boiler, furnace, or heater cabinet and easily accessible.

D. Do not use flexible pipe connections to boilers, furnaces, duct heaters, or hot water heaters.

E. Install dirt leg with pipe cap, 6” long minimum, on each vertical gas drop to heating equipment.

F. Use fittings for changes of direction in pipe and for branch runouts.

G. Protection Coatings: All underground steel pipes shall be wrapped with "Scotchrap" NP. 50 tape to give not less than two complete layers on the entire underground piping system. Factory wrapped pipe in accordance with American Water Works Standard, or X-tru-Coast Plastic coated pipe will be acceptable.

H. Paint main gas valve red and label "Main Gas Shut-off" with a permanent label.

I. Install earthquake activated gas shut-off valve downstream of meter before entering building with gas line (required only in seismic zones 3 and 4).

END OF SECTION 221320

SECTION 221513 - GENERAL SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions Division 01 and Section 220501.

B. Section 230000

1.2 SUMMARY

A. Provide and install a compressed air piping system as shown on the plans and stated here in.

B. The system shall be rigidly supported in place from the building structure - see Section 220529.

C. Provide and install all of the fittings, valves, joints, adapters, etc. as required for a complete and operable system.

1.3 SUBMITTALS

A. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.

B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hoisting and setting requirements, starting procedures.

1.4 PROJECT RECORD DOCUMENTS

A. Record actual locations of equipment and components. Modify shop drawings to indicate final locations.

PART 2 - PRODUCTS

2.1 MANUFACTURING

A. All pipe and fittings shall be domestic (USA) manufactured.

B. All valves shall be domestic (USA) manufactured.

2.2 PIPE AND PIPE FITTINGS

A. Steel Pipe: ASTM A53 or A120, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.
2. Joints: Threaded or welded to ANSI B31.1, ANSI B31.9 or ASME Sec. 1.

B. Copper Tubing: ASTM B88, Type L hard drawn.

1. Fittings: ASME B16.18, cast bronze, or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

C. Copper Tubing: ASTM B88, Type L annealed.

1. Fittings: ASME B16.26, cast bronze.
2. Joints: Flared.

D. Polyethylene Pipe: ASTM D2153, SDR 11.5.

1. Fittings: ASTM D2683 or ASTM D2513 socket type.
2. Joints: Fusion welded
3. Confirm use of polyethylene pipe.

E. IPEX “Duratec” Aluminum core with hope outer and inner layer ASTM E8 Fittings: Brass alloys with 0-ring seals ASTM F1974

2.3 VALVES

A. Ball Valves

1. Approved Manufacturers:
   a. Nibco
   b. Hammond
   c. Watts
   d. Apollo

B. Swing Check Valves

1. Approved Manufacturers;
   a. Nibco
   b. Hammond
   c. Watts
   d. Stockham

C. Air Outlets

1. Approved Manufacturers:
   a. Amflow

2. Quick Connectors: brass, snap on connector with self-closing valve.

D. Gauges

1. Provide and install pressure gauges at the indicated locations or at points of differential pressure.

E. Controls

1. Pressure Switch: Line voltage contractor to break at 100 psi with minimum differential of 200 psi.
2. Compressor Regulations: Lead-lag switch with time delay relay.

3. Electrical Alternation: Operate each compressor for 12 hours. If one compressor fails, second shall automatically maintain air pressure.

2.4 UNIONS AND COUPLINGS

A. Unions

1. Ferrous Pipe: 150 psig malleable iron threaded unions.
2. Copper Tube and Pipe: 150 psig bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

C. Flexible Connector: Neoprene with brass threaded connectors.

2.5 PRESSURE REDUCING VALVE

A. Approved Manufacturers

1. Ingersoll-Rand
2. Other acceptable Manufacturers offering equivalent products.
   a. Amflow
   b. Wilkerson

B. Pressure Reducing Station: consisting of automatic reducing valve and bypass, and low-pressure side relief and gage. Provide oil separator where indicated.

C. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upwards from reduced pressure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: The piping system shall be complete and operable, but not limited to the following:

1. Make air cock and drain connection on horizontal casing.
2. Install line size ball valve and check valve on compressor discharge.
3. Pipe drain to floor drain.
4. Connect condensate drains to nearest floor drain.
5. Install valved bypass around air dryer. Factory insulate inlet and outlet connections.
6. Install valved drip connection at low points of piping system.
7. Install take offs to outlets from top of main, with shut off valve after takeoff. Slope take off piping to outlets.
8. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.
9. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
10. Identify piping system and components as noted in section 220553.

3.2 FIELD QUALITY CONTROL

A. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ANSI B31.1.

B. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

C. Cap (seal) ends of piping when not connected to mechanical equipment.

END OF SECTION 221513

SECTION 224200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions section 01 and section 220501 apply to this section.

1.2 DESCRIPTION

A. A schedule of plumbing fixtures and equipment has been set-up on the contract documents. These units have been established as a standard for the systems being installed.

B. The manufacturer of the specified equipment directs the method of mounting the equipment and these directions shall be followed for a valid warranty.

C. The sizes capacity and method of connection shall comply with the manufacturer's directives. Any change there in places the warrantee responsibility on the contractor.

1.3 SUBSTITUTIONS

A. See section 220501-2.2 for an approved substitution, Part A thru H.

PART 2 - PRODUCTS

2.1 GENERAL

A. Interior exposed pipe, valves, and fixture trim shall be chrome plated.

2.2 WATER CLOSETS

A. Standard Fixture

1. Approved Manufacturers
    a. American Standard
    b. Zurn
    c. Kohler
    d. Sloan

B. Handicap Fixture

1. 18" rim height.
2. Approved Manufacturers
    a. American Standard
    b. Zurn
    c. Kohler
    d. Sloan

C. Seat

1. Provide split front type with check hinge.
2. Approved Manufacturers for Standard, Handicapped and Nursery Fixtures -
    a. Church

b. Beneke Corporation
c. Bemis
d. Kohler
e. Olsonite
f. American Standard

3. Approved Manufacturers for Nursery Fixtures
   a. American Standard
   b. Zurn
   c. Kohler

D. Supply Pipe & Stop

1. Provide stuffing box, brass stems and chrome plating
2. Approved Manufacturers
   a. Eastman
   b. Brass Craft
   c. Dearborn

E. Flush Valves

1. Approved Manufacturers
   a. Sloan
   b. Zurn
   c. American Standard

2. Flush Valve Filters
   a. SFOGI “Dirt Grabber” South Fork Manufacturing

F. Water Closet Supports

1. J.R. Smith
2. Zurn
3. Josam
4. Wade
5. Watts Drainage Products

2.3 URINALS

A. Fixture

1. Approved Manufacturers
   a. American Standard
   b. Zurn
   c. Kohler
   d. Sloan

B. Flush Valve

1. Approved Manufacturers
   a. Sloan
   b. Zurn
   c. American Standard

2. Flush Valve Filters
    a. SFOGI “Dirt Grabber” South Fork Manufacturing

C. Urinal Supports

1. J.R. Smith
2. Zurn
3. Josam
4. Wade
5. Watts Drainage Products

2.4 LAVATORIES

A. Self-Supporting Fixture

1. Size 20" x 18"
2. Approved Manufacturers
    a. American Standard
    b. Zurn
    c. Kohler
    d. Sloan

B. Countertop Fixture

1. Size 20" x 17" (maximum)
2. Approved Manufacturers
    a. American Standard
    b. Zurn
    c. Kohler
    d. Sloan

C. Fittings

1. Faucet and Drain
    a. Approved Manufacturers
        1) American Standard
        2) Moen Commercial
        3) Symmons
        4) Delta Commercial
        5) Kohler
        6) Zurn
        7) Sloan

2. Supply pipes with stops
    a. Provide stuffing box, brass stems and chrome plating.
    b. Approved Manufacturers
        1) Eastman
        2) Brass Craft
        3) Dearborn
        4) Zurn

3. Trap
    a. 17 ga tube "P" trap, chrome plated
    b. Approved Manufacturers
        1) Zurn
        2) Dearborn

3) McGuire
4) Keeney Manufacturing
5) Watts

D. All handicap accessible lavatories shall have traps and hot and cold water supplies insulated with flexible vinyl insulation manufactured by Truebro, Inc. Handi Lav-Gaurd Model No. 102W or No. 105W (no equals accepted).

E. Lavatory Supports for wall hung lavatories.

1. J.R. Smith
2. Zurn
3. Josam
4. Wade
5. Watts Drainage Products

2.5 HANDICAPPED LAVATORIES

A. Self-Supporting Fixture

1. Size - 20" x 27"
2. Approved Manufacturers
   a. American Standard
   b. Zurn
   c. Kohler
   d. Sloan

B. Fittings

1. Faucet & Drain
   a. Approved Manufacturers
      1) American Standard
      2) Symmons
      3) Moen Commercial
      4) Kohler
      5) Zurn
      6) Sloan

2. Supplies Pipe with stops
   a. Provide stuffing box, brass stems and chrome plating.
   b. Approved Manufacturers
      1) Eastman
      2) Brass Craft
      3) Dearborn
      4) Zurn

3. Traps
   a. 17 ga tube "P" trap, chrome plated
   b. Approved Manufacturers
      1) Watts
      2) Dearborn
      3) McGuire
      4) Keeney Manufacturing

C. All handicap accessible lavatories shall have traps and hot and cold water supplies insulated with flexible vinyl insulation manufactured by Truebro, Inc. Handi Lav-Gaurd Model No. 102W or No. 105W (no equals accepted).

D. Lavatory supports for wall hung lavatories.

1. J.R. Smith
2. Zurn
3. Josam
4. Wade
5. Watts Drainage Products

2.6 SERVICE SINK

A. Fixture

1. Floor Type
2. Approved Manufacturers
    a. American Standard
    b. Zurn
    c. Fiat Products Inc
    d. Acorn
    e. Kohler
    f. Stern-Williams

B. Fittings

1. Faucet
    a. Mounting height of 36 to 42” (see plans)
    b. Provide a 48” hose and wall clamp.
    c. Approved Manufacturers
        1) American Standard
        2) Zurn
        3) Moen Commercial
        4) Fiat Products Inc
        5) T & S Brass
        6) Kohler
        7) Chicago Faucets

2. Drain and Strainer
    a. Approved Manufacturers
        1) American Standard
        2) Zurn
        3) Kohler
        4) Fiat Products, Inc.

3. Trap
    a. Cast iron - “Deep Seal”

2.7 STAINLESS STEEL SINKS

A. Fixture

1. Self-rimming, 18 gauge stainless steel, satin finish.

2. Approved Manufacturers
    a. One, two or three Compartment
        a. Elkay
        b. Just
        c. Moen

B. Fittings

1. Faucet and Drains
    a. One. two or three compartment sinks
    b. Approved Manufacturers
        a. American Standard
        b. Moen Commercial
        c. Zurn
        d. Elkay
        e. Kohler
        f. Symmons

2. Waste
    a. Approved Manufacturers
        a. Dearborn
        b. Elkay
        c. Kohler

3. Supply pipes with stops
    a. Provide stuffing box, brass stems, and chrome plating.
    b. Approved Manufacturers
        a. Brass Craft
        b. Dearborn
        c. Eastman
        d. Zurn

4. Trap
    a. 17 gauge tube "P" trap, chrome plated
    b. Approved Manufacturers
        a. Watts
        b. Dearborn
        c. Zurn
        d. Keeney Manufacturing
        e. McGuire

2.8 FLOOR DRAINS

A. Approved Manufacturers

1. Josam
2. J.R. Smith
3. Wade
4. Zurn
5. Watts Drainage Products

2.9 HYDRANTS

A. Provide with integral anti-siphon device.

B. Approved Manufacturers (Exterior Frost Free)

1. Zurn
2. Wade
3. Smith
4. Josam
5. Woodford
6. J.R. Smith
7. Watts Drainage Products

C. Approved Manufactures (Interior)

1. Acorn
2. Chicago Faucet
3. Woodford

2.10 CLEANOUTS:

A. Furnish wall cleanouts with chrome wall cover and brass or stainless steel screw.

1. Finish Floors - Wade W-6000
2. Resilient Flooring - Wade W-6000-T
3. Finished Wall - Wade W8460R
4. Exposed Drain Lines - Wade W-8650A
5. General Purpose - Wade W-8550A
6. Approved Alternate Manufacturers for Cleanouts
    a. Josam
    b. Smith
    c. Zurn
    d. Watts Drainage Products

2.11 FLOOR SINK

A. 8” square top, medium receptor cast iron body with flanged receptor, acid resistant coated interior, and acid resistant coated half grate. Aluminum sediment bucket.

B. Approved Manufacturers

1. Commercial Enameling
2. J.R. Smith
3. Josam
4. Wade
5. Zurn
6. Watts Drainage Products

2.12 WORK ROOM SINK

A. Fixture

1. Self-rimming, 18 gauge SS with satin finish.
2. Approved Manufacturers
    a. Elkay
    b. Just
    c. Moen

B. Fittings

1. Faucet
   a. Approved Manufacturers
      1) American Standard
      2) Moen Commercial
      3) Kohler
      4) Elkay
      5) Symmons
      6) Zurn
      7) Chicago Faucets

2. Supply with Stops
   a. Provide stuffing box, brass stem, and chrome plating.
   b. Approved Manufacturers
      1) Eastman
      2) Brass Craft
      3) Dearborn
      4) Zurn

3. Waste
   a. Approved Manufacturers-
      1) Elkay
      2) Kohler
      3) Zurn
      4) Dearborn

4. Trap
   a. 17 gauge tube "P" trap, chrome plated
   b. Approved Manufacturers
      1) Watts
      2) Dearborn
      3) Zurn
      4) Keeney Manufacturing
      5) McGuire

2.13 WALL MOUNTED VITREOUS CHINA DRINKING FOUNTAIN

A. Include waste strainer integral with receptor.

B. Exposed metal trim shall be chrome plated brass.

C. Approved Manufacturers

1. American Standard
2. Crane
3. Kohler

2.14 SHOWERS

A. Column shower approved manufactures.

1. Bradley
2. Acorn

B. One piece seamless acrylic/fiberglass approved manufacturers.

1. American Standard
2. Aquatic Products
3. Kohler

C. Shower valves approved manufacturers.

1. American Standard
2. Bradley
3. Delta Commercial
4. Moen Commercial
5. Kohler
6. Symmons
7. Powers

2.15 WASHING MACHINE OUTLET BOX

A. 16 ga. steel with corrosion resistant epoxy finish.

B. Approved Manufacturers

1. Guy Gray Manufacturing, Co., Inc.
2. Symmons Industries, Inc.

2.16 EMERGENCY EQUIPMENT

A. Drench showers, eye wash.

B. Approved Manufacturers

1. Bradley
2. Guardian Equipment
3. Haws
4. Acorn Safety
5. Encom

2.17 ROOF/OVERFLOW DRAINS

A. Cast iron body, cast iron mushroom dome, sump receiver, and under deck clamps.

B. Approved Manufacturers

1. Josam Co.
2. J.R. Smith
3. Wade
4. Zurn
5. Watts Drainage Products

2.18 TRENCH DRAIN

A. Approved Manufacturers

1. ACO Plymer Products
2. Watts Drainage Products

3. Polydrain
4. Wade
5. J.R. Smith
6. Zurn

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures including traps and accessories with accessible stop or control valve in each hot and cold water branch supply line.

B. Mount fixtures per architectural elevations unless noted otherwise.

C. Make fixture floor connections with approved brand of cast iron floor flange, soldered or caulked securely to waste pipe.

D. Make joints between fixtures and floor flanges tight with approved fixture setting compound or gaskets.

E. Calk between fixtures and wall and floor with white butyl rubber non-absorbent caulking compound. Point edges.

F. All wall hung fixtures shall be securely attached to carriers, fixture hanger or arm shall be supported free of finished wall.

3.2 ADJUSTING, CLEANING

A. Polish chrome finish at completion of Project.

B. Clean sediment from aerators.

END OF SECTION 224200

SECTION 224300 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to -

1. Furnish and install items specified in this Section and/or described in Contract Documents.

B. Related Sections -

1. General Conditions, Division 01, and Sections 230501, 220700 and 230554 apply to this Section.

PART 2 - PRODUCTS

2.1 FLOW CONTROL FITTINGS:

A. Vandal proof type and fit faucet spout of fixture used. Flow shall be controlled as required by local codes.

2.2 CONDENSATE DRAINS

A. Provide Type M copper for condensate drains from air handling units, fan coil units, furnace coils, and cooler/freezers. Support piping and protect from damage.

B. Provide schedule 40 PVC for condensate from high tech furnaces, boiler, and water heater.

C. Install 3" deep seal, vented water trap adjacent to coil connection.

D. If condensing equipment is installed without a clarifier, the condensate lines shall be PVC pipe and fitting. Secure all piping.

2.3 PRESSURE GAUGES

A. Cast aluminum case

B. Chrome plated ring

C. Clear glass window

D. Phosphor bronze alloy steel bourdon tube

E. ½% scale range accuracy

F. 4½" diameter dial face

G. Range 0 to 100 psig.

H. Liquid Filled.

I. Approved Manufacturers -

1. Trerice 700 or equal
2. Crosby-Ashton
3. Marsh

2.4 BRASS GAUGE COCKS

A. Approved Manufacturers -

1. Ashcroft
2. Ernst
3. Trerice
4. Walworth

2.5 WATER HAMMER ARRESTERS

A. Provide and install a water hammer arrester at each hot and cold water connection and battery of fixtures.

B. Water hammer arresters shall be sized in accordance with PDI WH-201, precharged, suitable for operation in temperature range 100 to 300º F, and maximum 250 psig working pressure.

C. Approved Manufacturers:

1. Josam
2. J.R. Smith
3. Wade
4. Zurn

2.6 THERMOMETERS

A. 9" adjustable, angle, red reading, mercury type with cast aluminum case and 3½" chrome-plated brass separable socket.

B. Range -30 to 240° F.

C. Approved Manufacturers

1. Trerice BX9 or equal by
   a. H-B
   b. Palmer
   c. Taylor
   d. Weiss
   e. Weksler

PART 3 - EXECUTION

3.1 INSTALLATION

A. Connect gauges to pipe with ¼” connections utilizing cocks.

END OF SECTION 224300

SECTION 224700 - DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General conditions Division 01 and Section 220501 apply to this section.

B. Section 221116: Domestic Water Piping

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install drinking water cooling system units as described in contract documents.

PART 2 - PRODUCTS

2.1 GENERAL

A. Interior exposed pipe, valves, and fixture trim shall be chrome plated.

B. Flexible water piping shall be stainless steel braided supplies.

2.2 WATER COOLED DRINKING

A. Handicap Accessible Bi-Level Fountain

1. Include accessory fountain. Vandal proof operating bar on front and both sides. Flexi-guard or chrome plated brass bubbler.
2. Category four approved products. See section 016000 for definitions of categories.
   a. AcornAqua
   b. Elkay
   c. Halsey Taylor
   d. Oasis
   e. Haws
   f. Murdock

2.3 MANUFACTURERS

A. Contact Information

1. AcornAqua, City of Industry, CA www.acornagua.com
2. Elkay Manufacturing Co, Oak Brook, IL
3. Halsey Taylor, Oak Brook, IL www.halseytaylor.com
4. Murdock Manufacturing, City of Industry, CA ww.murdockmfg.com

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures with accessible stop or control valve

B. Mounting

1. Coordinate location of fountain with location and height of electrical outlet to ensure concealment of outlet by fountain.
2. Anchor bottom of fountain to wall.

3.2 CLEANING

A. Polish chrome finish at completion of project.

END OF SECTION 224700

SECTION 224710 - HANDICAP DRINKING WATER COOLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General Conditions, Division 01, and Sections 220501 General Plumbing Requirements and Section 221116 Pipe and Pipe Fittings apply to this Section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install handicap drinking water cooling system as described in Contract Documents.

PART 2 - PRODUCTS

2.1 GENERAL

A. Interior exposed pipe, valves and fixture trim shall be chrome plated.

B. Do not use flexible water piping.

2.2 HANDICAPPED FOUNTAIN

A. Vandal proof operating bar on front and both sides. One piece stainless steel back splash and basin. Flexi-guard or chrome plated brass bubbler. Handicap accessible B1-level fountains and single units.

B. Approved Manufacturers

1. Elkay
2. Halsey-Taylor
3. Haws
4. Oasis
5. Murdock

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor bottom of fountain to wall.

B. Top surface to be 40" to 32" above floor unless required otherwise by local code.

C. Install 3/8” IPS union connection and Chicago No. 376 stop to building supply line.

D. Install 1¼” IPS slip cast brass "P" trap 17 GA. Install trap so it is concealed.

END OF SECTION 224710

SECTION 230501 - COMMON HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Related Sections: Refer to "Electrical Requirements for Heating-Ventilation and Air-Conditioning (HVAC) Equipment" Section 230000 for basic electrical requirements for all mechanical equipment. Special and specific electrical requirements are specified within each respective equipment specification section. See Sections 220000 Plumbing and Section 260000 Electrical.

1.2 SCOPE OF WORK - GENERAL

A. This section specifies the basic requirements for HVAC installations and includes requirements common to more than one section of. It expands and supplements the requirements specified in sections of Division 01.

B. The work covered by the HVAC Sections of the Specifications shall include the furnishing of all materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of all mechanical work required in the Contract Drawings.

C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, it shall be the responsibility of the Contractor to provide all material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

D. The Contractor shall review all Contract Drawings and Specifications and include in his bid any work specifically as being performed in the HVAC. The Contractor shall be responsible for all work performed by his subcontractors.

1.3 DEFINITIONS

A. "Provide" shall mean "furnish and install complete and ready for intended use."

B. "Indicated" shall mean "indicated on drawings".

C. "Concealed" shall mean "hidden from sight as in trenches, chases, furred spaces or hung ceilings.

D. "Exposed" shall mean "not concealed", as defined above.

E. "Noted" shall mean "noted on drawings or in specifications".

F. "Contractor" also referred to as "this Contractor" or "the Contractor", shall mean "HVAC".

1.4 CODES AND STANDARDS

A. All mechanical work shall be in strict accordance with the most current edition of the International Building Code (IBC), International Mechanical Code (IMC), Uniform Plumbing Code (UPC), National Fire Protection Association (NFPA), International Fire Code (IFC), National Electrical Code (NEC), Energy Code IECC and ASHRAE-90.1, and all applicable state and local codes, laws and ordinances.

1.5 PERMITS AND FEES

A. The Contractor shall obtain and pay for all required permits and fees necessary to fully complete all work included in the Contract Drawings and Specifications.

1.6 CONSTRUCTION OBSERVATIONS:

A. During the course of construction of this project, the engineer shall visit the project site periodically on an as-needed basis. The construction observation intervals may vary depending on the progress and/or stage of construction and whether piping and/or ductwork, etc., is being placed below grade and/or concealed, surface mounted items, setting of equipment, equipment connections, etc. However, written field questions are encouraged and welcomed throughout the course of construction and shall be answered promptly in writing, to keep the project construction on schedule. The project foreman should have the building plans, construction schedules, etc., affixed in mind, so the mechanical systems being assembled, the setting of equipment, of parts and pieces, related to the project are anticipated, to prevent delays or emergencies.

(1) The engineer shall make one (1) final inspection. The contractor shall notify the engineer that the installation is complete, i.e., the systems are operating and have been tested and balanced, and everything is complete and operational, all equipment connections have been made and the owner's representatives have been trained. At this time the engineer, the contractor, and the owner's representative shall schedule a time to walk the project for evaluation, and record in writing the items found to be incomplete. The contractor shall make the corrections within one (1) week after this inspection. If at the conclusion of the observation tour the owner and engineer determine that additional visits are required to complete this project.

B. On extra visits, the contractor shall report to the engineer that all systems are complete, and the project is ready for the owner's acceptance.

1.7 INTENT AND INTERPRETATION

A. The Drawings and Specifications are intended to supplement each other, and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. The drawings are partly diagrammatic and do not necessarily show the exact location of all new piping and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of the equipment. They shall not be used for obtaining quantities or lineal runs of piping.

D. All grilles, fixtures or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

E. The location of the ductwork shall be checked to determine that it clears all openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.

F. HVAC drawings shall serve as the working drawings for this portion of the work, but the Contractor shall refer to the Architectural, Structural, Plumbing and Electrical drawings for additional detail affecting the installation of his work. Architectural drawings shall take precedence over the HVAC drawings if any dimensional discrepancies exist.

G. The approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the approval of the Architect and he reserves the right to make any reasonable changes in the locations indicated without additional cost.

H. The contractor shall not make a change in a system, system layout, and/or equipment, except he receives written approval or drawing over the signature of the engineer.

1.8 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 General Requirements for submittal definitions, requirements and procedures.

B1. ENGINEER APPROVED SHOP DRAWINGS OF DATA ON PRODUCT AND/OR EQUIPMENT BEING INSTALLED IN THIS PROJECT: After the contract is awarded the project and prior to the production of the specified equipment, the manufacturer shall have in hand an engineer approved shop drawing on that equipment being installed on this project. The manufacturer shall produce the product to comply with approved data. A brief description of submission to the engineer for evaluation is given below. Refer to identified sections for detailed submittal requirements.

B2. The **contractor shall submit one set of shop drawings** in a single binder (as stated in Section 1.11). From the submitted data the Design Engineer will review, make comments on or disapprove the submittals. The submittal will then be returned to the contractor via e-mail. Upon receipt of the e-mail, the contractor shall produce and assemble the required sets of shop drawings, operation and maintenance material, forming a manual that can be used by the owner in operating and maintaining the equipment.

C. Confirm equipment approved for the project.

1. Confirm that the equipment is approved for installation. It must be defined as to name, catalog number or both in the bid documents, which includes the published addendums. **If not approved, do not submit**.
2. Each unit shall state the name of the equipment manufacturer (name, address, phone, email, etc.) catalog number, size, physical dimensions and weight, energy characteristics (electrical and/or fuel), operating characteristics, materials from which constructed, any special conditions that may apply to the construction of the unit, etc.
3. The equipment must explain and define in detail the components that make-up the unit, so the owner and engineer can determine, define the replaceable parts during the life of the unit.
4. Complete operating instruction, normal maintenance recommendations, start-up procedures, etc.

5. In general, the contractor shall acquaint himself with the equipment to confirm that it can be installed as shown on the plans and from his experience perform the indicated function in the system where installed.
6. In the course of reviewing the shop drawings, **the Contractor shall confirm the energy usage** (gas, power, air, water, drains, etc.) and determine if these services are available at the equipment characteristics. Namely: confirm voltage, phase, etc., with the electrical contractor. Natural gas available with the plumber, also drains, water (hot and cold) pipe sizes, etc., or if there are discrepancies in the services. If the indicated equipment services are not available, inform the engineer by phone and in writing, also note on the shop drawing. This cooperative effort will correct a problem before the equipment arrives at the job site.

   The shop drawings shall also indicate the scheduled delivery dates the equipment will be at the site.

   If the contractor foresees any problems with equipment size, weight, delivery, etc., it shall be noted in writing, attached to the shop drawings.

1.9 RECORD DOCUMENTS

A. Contractor shall record differences between mechanical work as installed and as shown in Contract Documents on a set of prints of mechanical drawings to be furnished by Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 1 General Requirements.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Contractor shall prepare and submit Operation and Maintenance Manuals for mechanical systems provided under this Contract. Comply with Division 1 requirements for procedures and requirements for preparation and submittal of manuals.

B. Manual binder shall have permanent lettering of a contrasting color. Information to be included on the binder is as follows:

1. The front cover shall be lettered as follows:

HVAC
OPERATION AND MAINTENANCE
MANUAL
(PROJECT NAME)
(CITY AND STATE)
(YEAR)

OWNER: (NAME)
ARCHITECT: (NAME)
HVAC ENGINEER: Nielson Engineering Inc.
GENERAL CONTRACTOR: (NAME)
HVAC CONTRACTOR: (NAME)
The spine shall be lettered as follows:

HVAC O & M MANUAL (Year)
(Project Name)

C. Provide a master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.

D. Cover section shall consist of name, address, and phone number of Project Architect, General Contractor, Plumbing and HVAC Engineer, HVAC Contractor, and all HVAC Sub-Contractors.

E. Provide a separate section for each section of the specifications. Provide index for each section listing equipment included. Include all items specified in Section 23. Provide a list of each type of equipment supplied with the local supplier's name, address and phone number.

F. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be original. Copies are not acceptable.

G. When complete (before constructions begins) one (1) copy of the O & M Manual with approved submittals shall be placed in the Mechanical contractor's construction shack. At the close of the project, submit three (3) copies of manual shall be delivered to the owner at start-up and instruction for Owners use. Follow Division 01 requirements for additional manuals. Information to be included in manual:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping shut down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Schematic control diagrams (as built status) for each automatic control system. Mark correct operating setting for each control instrument on these diagrams. A second complete set of control diagrams encased in clear plastic laminate shall be furnished.
6. Valve schedule indicating the valve symbol (tag number), valve location by room number and description, valve purpose and system served, and valve size. Provide one corresponding set of full-size mechanical prints (as-builts status) showing these valve locations for cross-reference. A second complete set of valve schedules (8-1/2 in. x 11 in.) encased in clear plastic laminate and fitted in an aluminum holding frame shall be furnished to the Owner.
7. Testing, Adjusting and Balancing Report.
8. Test records and certifications.
9. Instruction period checklist.
10. Warranty information.

1.11 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. The Contractor shall instruct the Owner's Representative(s) in the Operation and Maintenance procedures described in the Operation and Maintenance Manual. Comply with Division 1 requirements.

B. Individuals present shall include Contractors, Subcontractors, and equipment factory representatives. These individuals shall assist in instruction and start-up.

C. Minimum instruction time shall be eight (8) hours unless otherwise specifically noted.

D. All mechanical systems shall be properly functioning prior to instruction period.

E. Contractor shall prepare a checklist of all equipment and systems requiring instruction and maintenance for verification by the Owner's Representative of satisfactory start-up and instruction. A copy of this checklist shall be included in the Operation and Maintenance Manual.

1.12 GUARANTEE

A. Contractor shall guarantee the satisfactory operation of all material and equipment installed under Division 23 and shall repair or replace to the satisfaction of the Owner or Architect, any defective materials, equipment, or workmanship which may show itself within one year from the date of acceptance.

1.13 CLEANING

A. The Contractor shall, at all times, keep the premises free from accumulations of waste material or rubbish.

B. At completion of the job, the Contractor shall remove all tools, scaffolding, and surplus materials.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. All materials, in general, shall conform to the requirements of all agencies or publications specified and described in Division 01 of the Contract Specifications.

B. Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

C. All specified materials and equipment shall be American manufactured and made.

2.2 LISTED EQUIPMENT

A. The current Electrical Code requires that all materials, devices, appliances, and equipment, shall be of a type that conforms to applicable standards or be indicated as acceptable by the established standards of the Underwriter's Laboratories, Inc. or other electrical product testing laboratories which are accredited by the department.

B. This statement is being interpreted by the State Electrical Inspector as follows: It is understood that many specialty items such as cast-iron boilers, certain items of air handling equipment and other building components are not available with a UL label covering the entire piece of equipment. The State will impose no requirement that an item of equipment be UL labeled unless it is available as a UL labeled items from at least two manufacturers. Electrical components of unlabeled equipment, such as motors, shall be labeled if they are available from at least two manufacturers.

C. If any building component is available with a UL label from at least two manufacturers, an identical or similar unlabeled component shall not be acceptable for installation in the State of Idaho. Should any such component be installed in the State of Idaho, it shall either be inspected and labeled by a UL representative or other authority approved by the State or it shall be replaced with a UL labeled component, before the building will be accepted by the State Electrical Inspector.

D. Consequently, it shall be the sole responsibility of the Contractor (through project suppliers and equipment manufacturers) to purchase and install only equipment bearing the UL label whenever that equipment so labeled is available. The Contractor, (should any equipment be installed without the proper UL label) shall bear the entire cost of correction to the satisfaction of the Idaho State Electrical Inspector.

2.3 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Substitute equipment is encouraged if it is truly an equal to the specified items.

1. The items and/or equipment specified in the contract documents are standard manufacturers items found in suppliers' catalogs, except it be indicated as special. The designer has taken time and effort to analyze, evaluate and prove to himself that the specified units will perform the function needed, wherein it is placed. This means the responsibility for the function of the specified equipment rests with the designer, who knows and understands what is to be accomplished.
2. If a **supplier** and/or the **contractor** desire to substitute equipment in place of a specified item, he may do so, but he takes upon himself or herself the **full responsibility** that the substituted equipment will equal all of the performing characteristics, functions, etc., and/or exceed the performance of the specified item. The substitute equipment shall be of such a physical size and weight that it will mount in the designated location without alterations to the building and the structure will carry the load. If for any reason the substituted equipment requires alterations or modification, in any form to the building and/or the structure, the costs shall be paid by the contractor and/or those requesting the substitutions.
3. Those interested in requesting a substitution shall submit a substitution request. The **Substitution request will be considered if it is at the office of the Engineer eight (8) working days prior to the day of bidding. The request shall include the following:**
   a. A statement certifying that the equipment proposed is equal to that specified; that it has the same mechanical operating characteristics, compatible dimensions, weight, electrical characteristics and meets the function and intent of the equipment named in the contract documents;
   b. The specification and catalog numbers of the substituted equipment;
   c. A pictorial and specification brochure.

4. Because of the short bidding period, (from issuance of drawing to bid date), between the substitution request and the bid date, the designer does not have adequate time to make a full evaluation of substitute equipment. Therefore, **those requesting the substitution** must accept **full responsibility** for the items being submitted for substitution (operating characteristics, physical size, weight, output, not increase the load, etc.). If at any time during the course of construction, **even up into the final completion**, if the designer finds the equipment does not meet the design criteria, comply with the performance, etc., **those requesting the substitution and the contractor have the responsibility to remove the substituted equipment and install the specified item at their expense.** There shall be no cost assessed to the owner and/or the designer and the replacement will not delay the completion of the project.

B. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents, nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer, who will issue interpretation and/or additional instructions to Bidders before the project is bid.

C. Any conflict arising from the use of **substituted equipment shall be the responsibility of the contractor,** who shall bear all costs required to make the equipment comply with the intent of the contract documents.

D. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

E. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued. This substitution may be made by a change order.

F. Approved equipment shall be so noted, in writing in a formally issued **Project Addendum**

PART 3 - EXECUTION

3.1 COORDINATION

A. Each Contractor shall at all times cooperate with other trades on the job to avoid friction and delay to the progress of work. All points in dispute shall be referred to the Architect.

3.2 SUPERVISION

A. This Contractor shall have in charge of the work at all times a thoroughly competent superintendent. Comply with Division 01 requirements.

3.3 WORKMANSHIP

A. The work under the mechanical contract shall be performed by workers skilled in the particular trade and include all work necessary to properly complete the installation in a professional manner so as to present a neat and finished appearance.

3.4 EXAMINATION OF SITE

A. The Contractor shall visit the site of the proposed work and become familiar with the conditions affecting the work. Contractor shall verify all measurements at the building before beginning work.

3.5 SITE UTILITY SERVICES

A. Where applicable, the Contractor shall make connections to existing permanent source utilities related to his contract immediately so as to provide the use of this service by other trades. Comply with Division 01 requirements.

REMODEL ONLY

3.6 EXISTING HVAC SYSTEMS

A. Confirm the locations of existing HVAC Equipment in the area of the facility being remodeled and relate on how it is adapted into the new scheme of things. The Contractor shall assume that connection points are as indicated on the plans. Where connection points are not within this radius, the Contractor shall contact the Architect for a decision before proceeding or may proceed at his own expense.

B. Existing HVAC piping (hot and chilled water), condensate, drain lines, condenser lines (liquid and suction), etc., that are found to obstruct the construction area (walls, floors and ceilings) and obstruct the removal of a wall, doorway or passageway, etc., shall be rerouted and/or relocated to clear the construction. The cost for this work shall be included as part of the project and shall be covered in the contractor's base bid.

C. If supply and/or return air ducts or exhaust ducts fall within or obstruct construction area for whatever reason, the contractor shall relocate these items to allow construction to proceed. The cost for this work shall be included as part of the base bid.

D. Existing extensions: piping (heating, chilled, condenser lines, etc.), ductwork, etc., that are noted to be extended and/or retrofit (for whatever reason) to accommodate added and/or new areas or facilities shall accomplish the intent for which the system was designed. When complete, the system and/or systems shall function as if they were new. This work shall be included in the base bid for the project.

Note: The specifications identify each system herein mentioned and the extension and additions shall adhere to the specifications defined for this phase of construction.

3.7 LAYING OUT WORK

A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined by the Architect's representative and/or secured from special details and drawings. Verify the physical dimensions of each item of mechanical equipment to fit the available space and promptly notify the Architect/Engineer prior to roughing-in if conflicts appear. Coordination of equipment to the available space and to the access routes through the construction shall be the Contractor's responsibility.

B. The contractor **shall hand deliver to the general contractor** a written statement and/or a manufacturer's brochure on the equipment being installed at each location. The information shall give the dimensions and weight (loads) of each unit being installed. The general contractor shall forward a copy of this information to the structural engineer and obtain from him confirmation that the building structure will accommodate the loads. If there be any problem the questioning party shall notify the mechanical engineer by phone and in writing.

3.8 CONTRACTOR COORDINATION

A. In the course of installing the systems defined in the contract documents, the contractor shall closely follow the plans, details and specifications (contract documents). The system design has been a careful and laborious undertaking, with the intent purpose of producing a system and/or systems that will serve the owner well with a minimum of maintenance. Thence, the contractor shall adhere as closely as possible to the plans, details, and specifications for each system. Questions and suggestions are encouraged as the project is being assembled. If for any reason, the contractor feels to deviate from the defined information, and finds a way, to improve the system, to make the system more easily assembled, make it operate more efficiently, etc., the contractor shall suggest the change to the engineer. Systems are designed to perform a specific function; the most minute change in assembly may change the function. If the engineer agrees with the change, he will authorize the contractor to proceed. Contractor cooperation and coordination is appreciated. If the contractor proceeds on construction without the designer's authorization, it shall be reworked, in accordance to plans and specifications, which work shall be at the contractor's expense.

3.9 CUTTING AND PATCHING

A. All cutting and patching of new or existing construction required for installation of mechanical systems and equipment specified in Division 23 shall be the responsibility of the Mechanical Contractor unless otherwise noted. Comply with Division 1 for general requirements for cutting and patching.

B. All cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. All patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of HVAC installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of HVAC equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.

G. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect/Engineer observation of concealed work.

H. Cut, remove and legally dispose of selected HVAC equipment, components, and materials as indicated, including, but not limited to removal of HVAC piping, heating units, ductwork plumbing, etc., and other HVAC items made obsolete by the new work.

I. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

J. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.10 EXCAVATION AND BACKFILL

A. Contractor shall provide all necessary excavation, shoring, and backfilling required for proper installation of HVAC work inside and outside the building. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to ½ the depth of the excavation, but in no instance closer than 2'. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of in designated areas approved for surplus material storage. Grading shall be done as necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained.

B. Trenches shall be excavated to depth indicated or required to establish indicated slope and invert elevations and to support bottom of piping or conduit on undisturbed soil. Trenches shall be of uniform width, sufficient to provide ample working room and a minimum of 6 to 9" of clearance on both sides of pipe or conduit.

C. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3" or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing. Where unyielding material is encountered in the bottom of the trench, such material shall be removed 6" below the required grade and replaced with materials described below for bedding.

D. Excavation for manholes, catch basins, inlets, or similar structures shall be sufficient to leave at least 12" clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

E. Bedding material shall be clean, sand-gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D 422.

U.S. Standard	Percent Passing Sieve Size
1"	100
No. 4	25-80
No. 200	0-10

F. Bedding material shall be placed to a depth of 6" over the top of piping. The bedding shall be brought up evenly on both sides of the pipe for the full length of the pipe.

G. Backfill for the remainder of the trench shall be satisfactory soil materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

H. Backfill soil materials shall be free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

I. Backfill to the required grade shall be placed in layers not exceeding 6” loose thickness for compaction by hand operated machine compactors, and 8” loose thickness for other than hand operated machines otherwise specified. Each layer shall be compacted to density as specified in Section 02200.

J. No underground lines shall be covered until the installation has been approved by the inspector having jurisdiction and the Owner's Representative.

K. Provide 4” thick concrete base slab support for piping less than 2' - 6" below surface of roadways. After installation and testing of piping, provide minimum 4” thick encasements (sides and top) of concrete prior to backfilling or placement of roadway subbase.

L. Bracing and shoring shall be provided where depth of excavation or character of ground render it necessary for personnel protection. Shoring shall be constructed of heavy timber planking with timber supports and shall conform to local and state safety laws and regulations.

M. Removal of bracing and shoring materials shall be done before backfilling except where necessary to insure against caving; in which case, it shall be withdrawn while backfilling is being done.

N. Provide barricades around all excavation. Barricades to be securely constructed.

O. The Contractor shall exercise extreme care while excavating in the area of utilities, carefully check for location of all possible utilities, whether shown on the drawings or not, and establish the location of all cutoff valves for ready shut-off of service in case of emergency. The Contractor shall be completely responsible for all damage to any utilities caused in excavating as well as damage to personnel and property caused by said damaged utilities whether shown on the drawings or not.

3.11 REPLACEMENT OF PAVING CONCRETE

A. All existing or new sidewalks, concrete paving, curbs, or asphalt paving removed or damaged by this Contractor during the period of the installation or as a result thereof, shall be replaced with like material in a manner as directed by and to the satisfaction of the Owner's Representative. Comply with Division 02 General Requirements.

3.12 OPENINGS IN DUCTWORK

A. All temporary openings in ducts shall be capped or sealed during construction. Caps shall be removed for final connections.

3.13 PROTECTION OF MATERIALS AND EQUIPMENT

A. Contractor shall be held responsible for any and all materials and equipment to be installed under this contract and will be required to make good at his own cost any injury or damage which materials or equipment may sustain from any source or cause whatsoever before final acceptance. Comply with Division 01 requirements.

3.14 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of HVAC materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.15 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Access doors or hatches required for servicing of mechanical equipment shall be furnished and installed as specified in the other Divisions and Sections of the Specifications.

3.16 PAINTING

A. Contractor shall touch-up scratched, or damaged factory finishes of HVAC equipment. Comply with Division 01 requirements.

B. Unless otherwise noted, all other painting of HVAC related items shall be according Section 099123 "PAINTING".

3.17 LUBRICATION

A. Contractor shall properly lubricate all pieces of equipment before turning the building over to the Owner. Comply with Division 01 requirements.

3.18 FINAL CLEANING

A. Refer to Division 01 for general requirements for final cleaning.

B. At time of final cleanup, all fixtures and equipment shall be thoroughly cleaned and left in condition for use.

3.19 FIRE PENETRATION SEALS

A. All penetrations through fire rated floors and walls shall be sealed to prevent the spread of smoke, fire, toxic gas, or water through the penetration either before, during or after a fire. The fire rating of the penetration seal shall be at least that of the floor to wall into which it is installed so that the original fire rating of the floor or wall is maintained.

B. The sealant shall remain soft and pliable to allow for the removal and/or addition of piping without the necessity of drilling holes. It shall adhere to itself to allow any and all repairs to be made with the same material. It shall permit the vibration, expansion and/or contraction of piping and ducts going through the penetration without the seal cracking or crumbling.

C. When damming materials are to be left in place after the seal is complete, all such materials shall be non-flammable.

D. When sealant is injected into a penetration, the foam shall expand to surround all items within the penetration and maintain pressure against the walls of the penetration. The foam shall cure within five minutes and be fire resistant at that time. No heat shall be required to further expand the foam to block the passage of fire and smoke or water.

E. All wall or floor penetration openings shall be as small as possible.

F. The foam sealant shall meet the entire fire test and hose stream test requirements of ASTM E119-73 and shall be UL classified as a Wall Opening Protective Device. The sealant shall be CHASE-FOAM, CTC PR-855 Fire Resistant Foam Sealant from Chase Technology Corporation, Huntington Station, New York 11746 or 3M Brand Fire Barrier caulk CP25, putty 303, wrap/strip FS 195 or sheet CS 195 from 3M Products Divisions, 224-4N 3M Center, St. Paul, MN 55144-1000.

END OF SECTION 230501

SECTION 230513 - ELECTRICAL REQUIREMENTS AND MOTORS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.

B. Specific electrical requirements for electric motor (i.e. horsepower, voltage, phase and electrical characteristics) for the mechanical equipment are specified within the individual equipment specifications and/or noted in the schedule on the drawings.

C. All magnetic motor starters and disconnect switches not furnished as an integral part of packaged mechanical equipment shall be provided under Division 23 - Mechanical.

D. Wiring from motors of mechanical equipment to disconnect switches or junction boxes, including pushbuttons, pilot lights, interlocks, speed controllers, and similar devices shall be the responsibility of this Contractor under Division 23 where not specifically indicated under Division 26.

E. Wiring of field-mounted float control switches, flow control switches, and similar mechanical/electrical devices provided for mechanical systems, to equipment control panels shall be the responsibility of this Contractor under Division 23 where not specifically indicated under Division 26.

F. Wiring required for Automatic Controls Section 23 0933 shall be the responsibility of this Contractor under Division 23.

1.3 REFERENCES

A.	NEMA Standard MG 1:	Motors and Generators.
B.	NEMA Standard ICS 2:	Industrial Control Devices, Controllers and Assemblies.
C.	NEMA Standard 250:	Enclosures for Electrical Equipment.
D.	NEMA Standard KS 1:	Enclosed Switches. Comply with National Electrical Code (NFPA 70).

1.4 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves as required by the individual equipment specification sections.

1.5 QUALITY ASSURANCE

A. All electrical components and materials shall be labeled by an approved testing agency (UL, ETL, CSA, etc.).

PART 2 - PRODUCTS

2.1 MOTORS

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
3. Two-speed motors shall have two separate windings on poly-phase motors.
4. Single speed motors shall be inverter - duty motors.
5. Temperature Rating: Rated for 40/C environment with maximum 50/C temperature rise for continuous duty at full load (Class A insulation). Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.

B. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

C. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.

D. Bearings: Ball or roller bearings with inner and outer shaft seals; re-greaseable, except permanently sealed where motor is normally inaccessible for regular maintenance; designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor; for fractional horsepower, light duty motors, sleeve type bearings are permitted.

E. Enclosure Type: Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation; guarded drip-proof motors where exposed to contact by employee or building occupants; weather-protected Type I for outdoor use, Type II where not housed.

F. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.

G. Noise Rating: "Quiet" rating on motors located in occupied spaces of building.

H. Efficiency: "Energy efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method "B". If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test method "B".

I. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features, and similar information.

2.2 STARTERS, ELECTRICAL DEVICES, AND WIRING

A. Motor Starter Characteristics: Enclosures NEMA, general purpose enclosures with padlock ears, except in wet location shall be NEMA 3R with conduit hubs. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and startup condition.

B. Manual switches shall have pilot lights and extra positions for multi-speed motors. Overload protection shall be melting alloy type thermal overload relays.

C. Magnetic starters shall have maintained contact pushbuttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated; trip-fee thermal overload relays each phase, interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls sections, built-in 120 volt control circuit transformer, fused from line side, where service exceeds 240 volts; externally operated manual reset, under-voltage release or protection.

D. Motor connections shall have flexible conduit, except where plug-in electrical cords are specifically indicated.

2.3 CAPACITORS

A. Features shall include individual unit cells, all welded steel housing, each capacitor internally fused, non-flammable synthetic liquid impregnated, craft tissue insulation and aluminum foil electrodes.

B. KVAR size shall be as required to correct motor power factor to 90% or better and shall be installed on all motors 1 horsepower or larger, that have an uncorrected power factor of less than 85% at rated load.

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION 230513

SECTION 230514 - VARIABLE FREQUENCY MOTOR DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

C. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

1.2 SUMMARY

A. This section specifies the basic requirements for motors and drives furnished by this Division and for electrical components which are an integral part of packaged mechanical equipment. Package components include, but are not limited to factory installed motors, starters, and disconnect switches, etc.

1.3 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled.

B. Variable speed drives shall conform to the latest standard of the following:

1. IEEE - Institute of Electrical and Electronic Engineers (including Harmonic Standard IEEE-519).
2. NEC - National Electric Code.
3. NEMA - National Electrical Manufacturers Association.
4. The complete packaged unit being supplied shall be listed and carry the label of at least one of the following:
    a. UL - Underwriters Laboratory.
    b. ETL - ETL Testing Laboratories, Inc.

1.4 SUBMITTALS

A. Submit complete product and application information for motors and for variable speed drives as follows:

1. Variable frequency drive vendor shall supply multiple sets of drawings of system being supplied, in strict compliance with the specifications. Drawing shall include, as a minimum:
    a. General arrangement of each unit showing size and incoming and outgoing conduit locations.
    b. Schematic.
    c. Connection diagram, sufficient to install drive system.

2. Each unit shall be supplied with four owner/maintenance manuals which shall include:
    a. Vendor information of equipment being supplied.
    b. Connection information.

c. Startup procedure.
d. Fault reset instruction.
e. Wiring diagrams (power and control).
f. Parts list.
g. Test results.
h. Harmonic voltage distortion on line with unit off.
i. Harmonic voltage distortion with unit on line.

3. Submit product data for motors, belts, drives, starters, and other electrical components with submittals data required for the equipment for which it serves, as required by the individual equipment specification sections. Verify project electrical characteristics with submittal. Confirm suitability for altitude, maintaining full nameplate rating plus service factor. Include this data in maintenance manual in accordance with Section 230501"Operation and Maintenance Manuals".

1.5 REFERENCES

A. NEMA Standard MG 1: Motors and Generators.

B. NEMA Standard ICS 2: Industrial Control Devices, Controllers and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment.

D. NEMA Standard KS 1: Enclosed Switches.

E. Comply with National Electrical Code (NFPA 70).

1.6 WARRANTY

A. General: The variable frequency drive vendor shall furnish a written warranty consisting of the following:

B. Warranty parts and labor for five years after start up.

PART 2 - PRODUCTS

2.1 MOTORS

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
3. Two-speed motors shall have two separate windings on poly-phase motors. Confirm 2-speed starter requirements with Division 26.
4. Single speed motors shall be inverter - duty motor.
5. Temperature Rating: Minimum rate for 40/C environment with maximum 90/C temperature rise for continuous duty at full load (Class H Insulation for altitude, Class B leads allowed).
6. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly timed spaced starts per hour for manually controlled motors.

7. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors, 1.0 for TEFC motors.
8. Pump motors shall have an end shield with ventilation openings beneath the motor.
9. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
10. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
11. Bearings:
    a. Ball or roller bearings with inner and outer shaft seals;
    b. Re-greaseable, except permanently sealed where motor is normally inaccessible for regular maintenance;
    c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor;
    d. For fractional horsepower, light duty motors, sleeve type bearings are permitted;

12. Enclosure Type:
    a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
    b. Guarded drip-proof motors where exposed to contact by employee or building occupants;
    c. Weather-protected Type I for outdoor use, Type II where not housed.

13. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
14. Noise Rating: "Quiet".
15. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method "B". If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test method B.
16. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features, and similar information.
17. Acceptable Manufacturers: Allis-Chalmers, Baldor, Century, General Electric, Gould, Lincoln, Louis-Allis, Marathon, Reliance, U.S. Motors, Westinghouse.

2.2. MOTOR DRIVES

A. Furnish V-belt drives of fabric and rubber construction by Browning, Dodge, Woods. Multiple belts shall be matched, and all belts shall be adjusted to drive the apparatus properly and to prevent slippage and undue wear in starting. Drives shall be designed for 150% of the specified motor nameplate ratings. Bush all drives. Belts shall be A, B or C section. Narrow gauge belts are not acceptable.

B. Coupled drives by Browning, Dodge or Woods.

C. Provide for each V-belt drive, coupled drive or rotating shaft a galvanized iron metal guard which shall be constructed around an angle iron frame, securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements. Provide hinged access doors not less than 6" X 6" for access to motor and fan shaft for test purposes. For double inlet fans, construct the belt guard cover of ½" mesh expanded metal, arranged as not to restrict the air flow into the fan inlet.

2.3. VARIABLE SPEED DRIVES

A. General: Furnish and install Variable Frequency Drives (motor speed controllers) with a fused disconnect and associated control signal components, power factor compensation and related cabinets, devices, ventilation, etc. Sizes and capacity as scheduled on the drawings. Drives shall be rated for constant torque application and not for variable torque application.

1. Verify compatibility of each VFD System being supplied with the furnished motor. If a new motor is being supplied, the VFD vendor shall supply the VFD and verify with the motor supplies for compatibility and warrant each and the combination as a coordinated package.
2. Furnish each system in a NEMA 1 enclosure either wall-mounted or free standing, with fan forced filtered ventilation.
3. Furnish each system with silk screened or engraved labels on all door operator and pilot devices, attached with screws, rivets or adhesive.
4. Each system shall bear an electrical shock warning label to warn personnel that a potential of electric shock exists.
5. Supply each system complete, wired with all components assembled in a single enclosure including, but not limited to the VFD units, contactors, door interlocked circuit breaker, static pressure or differential pressure transducer and controller and other items listed in this specification or shown on the plans. Units requiring mounting and interwiring of separate bypass enclosure are not under this specification.
6. Supply a complete set of engineering drawings consisting of, as a minimum, general arrangement, power wiring diagram, control wiring diagram and schematic of VFD System components, options, and equipment and tests included to meet power quality requirements of part E.
7. Furnish an owner's manual consisting of catalog sheets showing actual components and parts numbers. Manual shall also show test certificates, warranty and service personnel responsible for warranty.
8. Furnish factory trained VFD System installation and start-up and warranty service. Mount unit and connect to power supply, mount and wire remote devices.

B. Construction: Assemble the Variable Frequency Drive units and components in a NEMA 1 enclosure.

1. The Variable Frequency Drive inverter shall be altitude compensated and sized for the elevation at which the unit will be installed. The inverter shall operate in an ambient temperature of -10ºC to 50ºC and a humidity of 0 to 90% non-condensing.
2. Mount the Variable Frequency Drive inverter unit on a removable panel along with all other components such that, if required, the panel can be removed from enclosure for maintenance or part replacement.
3. Mount the door with a minimum of two hinges with removable pins. Door shall be rigid and large doors shall have additional hinges and stiffening steel.
4. Paint enclosure, two coats over primer, with high grade enamel, with a minimum of 50 - 70 microns thick.
5. The enclosure shall be force ventilated and the exhaust ports covered with louvers. All components of the system, except sensors, shall be contained in this single enclosure as an integral package.
6. Door mounted operator devices shall be industrial, oil tight, equivalent to control center devices.
7. Control power for operator devices and customer connections shall be 120 volts. The control power transformer shall be a "Machine Tool" type and have both primary and secondary fusing.

C. Standard Features: The following features shall be standard on all VFD units furnished.

1. The VFD unit shall be a solid state AC and DC converter sinusoidal pulse-width modulation (PWM) type. The altitude adjusted horsepower rating shall be equal to or greater than the motor HP that the unit is supplying.
2. The unit shall operate on:
   a. Input Voltage 460 VAC ± 10% (Nominal 480 Volts).
   b. Input Frequency 60 Hz ± 5%.
3. Comply with IEEE 519-2014, 3% or 5% input line reactor.
4. Motor braking torque shall be available by means of regenerative braking.
5. The drive shall contain an output frequency clamp such that minimum or maximum output frequency can be set at desired limits.
6. Rated overload current shall be 110% for one minute.
7. The VFD unit shall have an adjustable acceleration/deceleration time setting from one second to 120 seconds.
8. The VFD unit shall maintain a 95% or better displacement power factor over the entire speed range.
9. The VFD unit shall maintain a 95% or better output/input efficiency over the entire speed range.
10. The inverter shall be supplied with a door interlocked input disconnect motor circuit protector. The MCP shall allow trip adjustment sufficient to start the motor across the line in the bypass mode (if bypass option is specified) and normally be set at a minimum setting for maximum protection in the VFD mode. The door mounted handle shall be lockable in the off position.
11. Provide the following door mounted operator controls as a minimum:
    a. Hand/Off/Auto Switch.
    b. Local/Remote Switch.
    c. Frequency Setting Speed Pot.
    d. Frequency Indication Meter Calibrated in % Speed.
    e. Power on Light.
    f. VFD Enable Light.
    g. VFD Fault Light.
    h. External Fault Light (safeties interlock).
12. The inverter shall have a minimum of the following protective features with an alarm display indication:
    a. Overcurrent Shut-off.
    b. Regenerative Overvoltage.
    c. Electronic Thermal Protector.
    d. Heatsink Overheat.
    e. Instantaneous Power Failure.
    f. Ground Fault.
13. Provide the following termination points on terminal strip for field connections:
    a. Safeties Interlock.
    b. Remote Start-Stop Contact.
    c. Remote VFD/Fault Contacts (N.C.).
    d. Remote VFD/Bypass Enable Contacts (N.O.).
    e. Remote Electronic Signal Input.

14. Initiate auto restart by means of an automatic time delayed restart after recovering from under voltage or loss of power. The inverter shall not automatically restart after overcurrent, overvoltage, over temperature, or any other damaging conditions but shall require a manual restart.
15. Remote input signal connection terminals (-05 VDC or 0-10 VDC = 0-100% speed or 4-20 mA = 20-100% Speed).

D. Additional configuration features:

1. Bypass Option: The inverter shall be supplied with a manual bypass contactor arrangement for transfer to the feeder line to operate at constant speed. The contactors shall be electrically and mechanically interlocked and supplied with an adjustable motor overload.
2. A VFD isolation switch shall be provided to allow maintenance on the VFD while in the bypass mode. Furnish prewired in the same enclosure, including contactors, VFD isolation switch, motor overload VFD/Bypass selector switch and Bypass ON light.
3. Digital or Analog Ammeter.
4. Digital or Analog Voltmeter.
5. Ammeter/Voltmeter Switch for 3 phase operation.
6. Frequency Jump: The drive shall be supplied with a frequency jump control to avoid operating at a point of resonance with the natural frequency of the machine.
7. Series line reactors shall be provided as standard equipment.
8. Drive Speed Control, I/E or I/I or E/E/ or E/I transducers as needed.
9. Synchronous transfer shall allow transfer from VFD to utility line and back to VFD unit while motor is running.
10. Motor braking torque shall be available by means of adjustable regenerative braking or DC dynamic braking.
11. VFD Unit shall have computer option through the addition of a RS 232 data cord.
12. Remote Digital/Analog Speed Meter with 4 - 20 ma signal. Locate at central control console.

E. Acceptable Manufacturers: Acceptable manufacturers of VFD equipment shall meet the following requirements (1 through 6).

1. Supplier of VFD Systems must be in the primary business of supplying Variable Frequency Drives and have a minimum of five (5) years of service in that business.
2. Vendor must have local service center with factory spare parts inventory and factory authorized service technician on call 24 hours/day.
3. VFD units supplied in response to this specification shall be labeled by UL, CSA, or ETL. Note, the entire unit shall carry the label not just a component.
4. The following VFD suppliers have been approved providing that all points of this specification are adhered to:
    a. Energy Management Corporation using Mitsubishi or Saftronics drives.
    b. Danfoss.
    c. Reliance.
    d. Toshiba
    e. Yaskawa
    f. ABB

5. VFD vendors must have prior approval by engineer before quoting equipment specified. If not listed above, vendor must apply to engineer for approval 10 days prior to bid date showing point by point compliance with this specification including sample of typical harmonic voltage distortion test report. In compliance with general requirements of the specification.

6. The VFD shall be the manufacturer's current manufacturing model. Outdated VFD will not be accepted.

F. Testing: Prior to shipping, test each unit and submit certified test report with each unit. Standard tests to include:

1. Visual inspection, consisting of checking unit enclosure, wiring, connections, fasteners, covers and locking mechanism.
2. High pot test; two (2) X rated voltage plus 1000 volts AC of 60 seconds shall be applied per UL 508 on all peripheral drive system power components (circuit breakers, contractors, motor overloads, line reactors, disconnect switches, etc.) as a complete package. A copy of test results shall be included in operation manuals.
3. Motor run test.
4. Control panel devices, test all devices and lights.
5. Optional equipment, test optional equipment specified with VFD system.
6. Special tests, as required and specified.

PART 3 - EXECUTION

3.1. INSTALLATION

A. Field mounting pad and power connections shall be provided by contractor.

B. Vendor shall supply field start-up service by an authorized factory service representative consisting of system check-out, start-up and system run. The vendor shall provide warranty and authorized factory service include operator training. A written certificate of same shall be provided at start-up. Provide written certified start-up report. VFD service technicians shall be full time employees of the vendor or manufacturer, primarily engaged in VFD service work during normal business hours but on call 24 hours. Start-up by sales representative is not acceptable.

C. Startup/adjustment effort shall have at least two segments.

1. Prior to Test and Balance work to place equipment in operation.
2. At conclusion of Test and Balance work to adjust units to actual operating conditions.

D. The following adjustments and tests shall be performed as a minimum with certified copies included in the maintenance and operation manual.

1. Verify that the input voltage is within the manufacturer's specification tolerances.
2. Verify that the motor rotation is correct in all modes of operation.
3. Verify all operator devices, programming and monitoring functions to be fully operational.
4. Verify operation of all field signal control connections.
5. Measure and record system output voltage and current at 50% and 100% speed. Tune the output voltage to correspond to motor nameplate rating at full speed. Check full load current measurements against nameplate data.
6. Make all parameter adjustments to tune and optimize the ASD system to the application. Record all configuration values as part of this report.
7. Conduct harmonic tests as identified in part E. Measurements shall be recorded for each unit with the ASD system off, running at 50% speed, and running at full speed and load.

END OF SECTION 230514

SECTION 230548 - VIBRATION AND SEISMIC CONTROL FOR HVAC PIPING, DUCT WORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to:

1. Quality of and requirements for anchorage and seismic restraint systems and vibration isolation systems for HVAC piping and equipment.

B. Related Sections:

1. Section 033000: Cast-In-Place Concrete.
2. Furnishing and installing of seismic restraint and vibration isolation systems is by installer of equipment requiring such systems. Manufacturers of equipment specified for seismic restraint shall provide product data needed for calculation of seismic restraint needs. This information shall include, but not be limited to, equipment dimensions, dimensioned anchor points, operating weight, and center of gravity dimension.

1.2 REFERENCES

A. American Society for Testing and Materials:

1. ASTM A 615-04b, 'Standard Specification for Deformed & Plain Billet-Steel Bars for Concrete Reinforcement.'

B. Sheet Metal & Air Conditioning Contractors National Association / American National Standards Institute:

1. SMACNA / ANSI 001-2000, 'Seismic Restraint Manual: Guidelines for Mechanical Systems.'

1.3 SUBMITTALS

A. Product Data:

1. Restraint system and anchorage method to be used for each piece of equipment.
2. Seismic restraints and calculations for all flexible mounted equipment.
3. Vibration isolators and flexible couplings.
4. Clearly outlined procedures for installing and adjusting isolators, seismic bracing anchors, and snubbers.

B. Shop Drawings:

1. Show size, hanger length, and location of seismic restraints for piping and ductwork.
2. Show details for each isolator and seismic brace with snubbers proposed for specified equipment.
3. Show details for proposed structural steel frames and rails and for anchors to be used in conjunction with isolation of equipment.

4. Show locations of piping and ductwork restraints on installation and fabrication floor plans (not bid set of documents of floor plans), noting size and type of restraint to be used.
5. Show details of supports, hangers, anchorage, and bracing for isolated equipment as designed or proposed by professional engineer employed by Restraint Manufacturer and qualified with seismic experience in bracing for mechanical equipment. Shop drawings submitted for seismic bracing and anchors shall bear engineer's signed professional seal.
6. Include anchor bolt calculations, signed and stamped by registered engineer, showing adequacy of bolt sizing and type.
    a. Calculations shall include anchor embedment, minimum edge distance and minimum center distance.
    b. Design lateral forces shall be distributed in proportion to mass distribution of equipment.
    c. Furnish calculations for anchors on restraint devices, cable, isolators, and on rigidly mounted equipment.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: System design and installation shall meet seismic requirements as defined in current edition of International Building Code, Section 1621 and applicable state and local codes in accordance with the site's Seismic Zone and with the minimum restraint capability of .3 g. Explicit requirements and details can be found in referenced SMACNA Manual.

B. Seismic Requirements: Mechanical equipment, piping, and ductwork shall be braced, snubbed, or supported to withstand seismic disturbances and remain operational.

C. Vibration Isolation Requirements: Isolate equipment from structure by means of resilient vibration and noise isolators.

PART 2 - PRODUCTS

PROJECT SPECIFIC: Edit materials list below to include only those materials or elements that are actually part of the Mechanical design.

2.1 MATERIALS

A. Isolation and Seismic Equipment:

1. Piping: Restrain piping in accordance with Figures 4.11 to 4.19 in SMACNA Manual.
2. Equipment with Fixed Anchor or Support:
    a. Restraint designed according to the International Building Code.
    b. Horizontal force factor for elements of structures:
        1) In addition, vertical force restraint requirement shall be computed at 1/2 value of horizontal forces.
        2) Restrain equipment not anchored directly to floors by cable system designed and furnished by Restraint Manufacturer.

3. Ductwork: Restrain ductwork in accordance with Figures 4.2 to 4.10 in SMACNA Manual as appropriate.

B. Vibration Isolation Requirements:

1. Unless otherwise noted, isolate HVAC equipment one horsepower and over from structure by means of resilient vibration and noise isolators in accordance with ASHRAE HANDBOOK 2003 - HVAC Applications, Table 42, Chapter 47.
2. Design and install isolation equipment, hangers, connections, and other isolating devices to prevent transmission of vibration to structure from equipment and associated piping and ductwork.
3. For floor-mounted equipment, use recommendations of Table 45.
4. For roofs and floors constructed with open web joints, thin long span slabs, wooden construction and unusual light weight construction, evaluate equipment weighing more than 300 pounds to determine additional deflection of structure caused by equipment weight. Isolator deflection shall be 15 times additional deflection or deflection shown in Table 45, whichever is greater.
5. Under-Equipment Spring Isolators:
    a. Equal to Mason SSLFH earthquake motion restrained spring mounts with freestanding stable steel springs, leveling bolts, corrosion resistant finish, motion limiting design, uplift restraining bolts, and ¼" ribbed neoprene noise stop pad.
    b. Isolators shall accept force in any direction up to 1.0 g without failure and shall limit movement to ¾" in any direction.
    c. Springs shall have 50% overload capacity.
    d. Size as required to achieve specified static deflection.
    e. Outer diameter of spring proper shall not be less than 0.8 of spring height when in loaded position.

6. Overhead Support Spring and Rubber Hangers:
    a. Combination spring and neoprene hangers.
    b. Hanger bracket shall have 500% overload capability and shall allow up to 15º hanger rod misalignment without short-circuiting.
    c. Springs shall have 50% overload capacity.
    d. Provide seismic bracing as required.

7. Isolate piping and ductwork in mechanical equipment room and piping and ductwork three supports away or 50' from other mechanical equipment, whichever is greater, from structure by means of vibration and noise isolators.
    a. Isolate suspended piping with combination spring and fiberglass hangers in supporting rods.
    b. Support floor-mounted piping directly on spring mounts.

8. Isolate vertical pipe risers from structure using vibration and noise isolating expansion hangers having minimum rated deflection of four times anticipated pipe movement. Enclose in housing for fail-safe equipment.
9. Incorporate flexible connectors in piping adjacent to reciprocating equipment.
10. Incorporate flexible connections in ductwork adjacent to air-moving units.
11. Elastomeric Isolator: Neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives.
12. Nuts, Bolts, And Washers: Electroplated zinc.
13. Isolators Exposed to Weather: Cadmium plated and neoprene coated springs.

C. Seismic restraint equipment and resilient isolation devices shall be designed and furnished by single Manufacturer:

D. Type One Acceptable Manufacturers:

1. Amber / Booth Company, Houston, TX www.amberbooth.com
2. Mason Industries Inc, Hauppauge, NY www.mason-ind.com.
3. Vibration Mountings and Control Inc, Bloomington, NJ (201) 838-1780.
4. Equal as approved by Architect before bidding. See Section 01 6000.

2.2 FINISHES

A. Clean and paint steel components. Thoroughly clean structural steel bases of welding slag and prime with zinc-chromate or metal etching primer. Etch and paint hot dipped galvanized steel components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Isolation Equipment:

1. Mount vibration isolated equipment on rigid steel frames or concrete bases unless Equipment Manufacturer certifies direct attachment capability.
2. Install snubbers with factory set clearances.
3. Piping:
   a. Protect isolated and non-isolated piping 2½" inside diameter and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motions.
   b. Locations shall be as scheduled and include, but not be limited to:
      1) At drops to equipment and at flexible connections.
      2) At 45º or greater changes in direction of pipe.
      3) At horizontal runs of pipe 30" maximum on center spacing.
      4) Gas piping shall have additional restraints as scheduled.

4. Ductwork:
   a. Protect isolated and non-isolated rectangular ductwork 4 ft² in cross-sectional area and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motion.
   b. Locations shall be determined by Seismic Restraint Manufacturer and include, but not be limited to:
      1) Horizontal runs of ductwork 30" maximum on center spacing.
      2) 45º or greater changes in direction of ductwork.
      3) Each end of duct runs and drops of equipment.
      4) Each flexible connection.

B. Vibration Isolation: Install piping and ductwork to prevent transmission of noise and vibration into structure.

END OF SECTION 230548

SECTION 230553 - MECHANICAL EQUIPMENT AND PIPING IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install identification of equipment and piping as described in Contract Documents.

PART 2 - PRODUCTS

2.1 PAINT

A. Benjamin Moore Impervo or equivalent by Paint Manufacturer approved in Architectural Painting Sections.

B. Use appropriate primer.

2.2 LABELS

A. Black Formica with white reveal on engraving.

PART 3 - EXECUTION

3.1 APPLICATION

A. Engraved Plates

1. Identify thermostats and control panels in mechanical rooms, furnaces, boilers and hot water heating specialties, duct furnaces, air handling units, electric duct heaters, and condensing units with following data engraved and fastened to equipment with screws
   a. Equipment mark noted on Drawings (i.e., CU-1)
   b. Area served (i.e., Gym, Administration)

B. Self-Sticking Vinyl Markers

1. Locate identifying legends and directional arrows at following points on each piping system
   a. Adjacent to each item of equipment and special fitting.

b. At point of entry and exit where piping goes through wall.
c. On each riser and junction.
d. Every 50’ on long continuous lines.

2. Domestic Hot & Cold Water Piping Identification
   a. Identify domestic hot and cold water piping above and below ceilings with stenciled letters “HW” and “CW” respectively.
   b. Letters shall be 1” high. Provide “Direction of Flow” arrow at each stencil.
   c. Paint color shall be as specified below.

C. Painting: All pipe painting shall be provided for by the installing contractor i.e.: Fire sprinkling by the Fire Sprinkler contractor, plumbing by the Plumbing Contractor.

D. Identification shall comply with, but not limited to the following:

PIPE PAINTING AND LABELING LEGEND

SERVICE & LABEL	SYMBOL	LABEL COLOR * BACKGROUND	LETTER	PIPE COLOR **
CHILLED WATER SUPPLY	CWS	GREEN	WHITE	LIGHT BLUE
CHILLED WATER RETURN	CWR	GREEN	WHITE	LIGHT BLUE
COOLING TOWER SUPPLY	CTS	GREEN	WHITE	LIGHT GREEN
COOLING TOWER RETURN	CTR	GREEN	WHITE	LIGHT GREEN
HEAT PUMP SUPPLY	HPS	GREEN	WHITE	PASTEL ORANGE
HEAT PUMP RETURN	HPR	GREEN	WHITE	PASTEL ORANGE
HEATING WATER SUPPLY	HWS	YELLOW	BLACK	DARK ORANGE
HEATING WATER RETURN	HWR	YELLOW	BLACK	DARK ORANGE
HP STEAM	HP ST	YELLOW	BLACK	DARK PURPLE
LP STEAM	LP ST	YELLOW	BLACK	DARK PURPLE
PUMPED CONDENSATE	PCOND	YELLOW`	BLACK	PURPLE
GRAVITY CONDENSATE	GCOND	YELLOW	BLACK	LIGHT PURPLE
			BLACK	LIGHT PURPLE

* Ref. ANSI codes 13.1 (1981). See Specs.

** Exposed piping in mechanical rooms, boiler rooms, etc., shall be painted color indicated on chart.

E. SIZE OF LETTERS AND LENGTH OF FIELD

OD OF PIPE OR COVERING	SIZE OF LETTERS	LENGTH OF COLOR FIELD
¾” TO 1-1/2"	½"	8"
1-1/2" TO 2"	3/4"	8”
2-1/2” TO 6"	1-1/4"	12"
8” TO 10"	2-1/2"	24"
OVER 10"	3-1/2"	32"

F. Paint Specification: All surfaces to be painted shall be prepared in accordance with the detailed painting specifications in the Painting Section of these specifications. Surfaces that are not subjected to temperatures higher than 212º F shall be painted as specified for the area in which they are located. Pipes, valves, or other equipment subjected to temperature above 212° F, shall be painted with heat resisting black enamel or heat resisting aluminum paint as specified below. The Owner's Representative shall designate surfaces to be painted aluminum painted at least three coats. Colors shall be selected by Owner's Representative.

G. Heat resisting black enamel shall be Sta-Black as manufactured by Pratt and Lambert Co., or Ebonite Boiler and Stack Paint as manufactured by W.P. Fuller Co. or approved equal suitable for use at temperatures of at least 450°F.

END OF SECTION 230553

SECTION 230554 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 SUMMARY

A. This section includes mechanical identification materials and devices.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.

B. Product data for identification materials and devices.

C. Samples of color, lettering style, and other graphic representation required for each identification material and device.

D. Valve Schedules: Submit valve schedules for each piping system. Reproduce on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification. Mark valves intended for emergency shutoff and similar special uses. Furnish extra copies (in addition to mounted copies) for Maintenance Manuals.

1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation of identifying devices after completion of covering and painting where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 IDENTIFYING DEVICES AND LABELS

A. General: Products specified are manufacturer’s standard products of categories and types required for each application as referenced in other Division 23 Sections. Where more than single type is specified for listed application, selection is Installer’s option, but provide since selection for each product category.

B. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ASME A13.1. Minimum letter height is 1-1/4" for ducts and ¾" for access door signs and similar operational instructions.

1. Material: Fiberboard or brass.
2. Stencil Paint: Exterior, oil based alkyd gloss black enamel, except as otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based alkyd enamel in colors according to ASME A13.1, except as otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard pre-printed, color-coded, pressure-sensitive vinyl pipe markers, with permanent adhesive conforming to ASME A13.1.

D. Pipes Smaller Than 6": Full-band pipe markers, extending 360º around pipe at each location.

E. Pipes 6" And Larger: Either full-band or strip-type pipe markers, at least 3 times the letter height and of the length required for the label.

F. Lettering: Manufacturer's standard pre-printed terms as selected by Architect.

G. Lettering: Use piping system terms as indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering (to accommodate both directions), or as separate unit, on each pipe marker to indicate direction of flow.

H. Plastic Tape: Manufacturer's standard color-coded, pressure sensitive, self-adhesive, vinyl tape, at least 3-mils thick.

1. Width: 1-1/2" wide on pipes with outside diameters (including insulation) less than 6"; 2½" wide for larger pipes.
2. Color: Comply with ASME A13.1, except where another color selection is indicated.

I. Valve Tags: Stamped or engraved with ¼" letters for piping system abbreviation and ½" sequenced numbers. Provide a 5/32" hole for fastener.

1. Material: 19-gauge polished brass
2. Material: 0.032" thick aluminum
3. Material: 19-gauge stainless steel
4. Material: 3/32" thick plastic laminate having 2 black surfaces and a white inner layer.
5. Material: Valve manufacturer's standard solid plastic.
6. Material: Size: 1½" diameter, except as otherwise indicated.
7. Shape: As indicated for each piping system.

J. Valve Tag Fasteners: Brass chain (wire link or beaded type) or brass S-hooks.

K. Access Panel Markers: 1/16" thick engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8" center hole for attachment.

L. Valve Schedule Frames: Glazed extruded aluminum display frame, with screws for removable mounting on masonry walls for each page of valve

1. Glazing: ASTM C 1036, 2.5 mm, single thickness, sheet glass.
   a. Type: Type I, flat transparent.
   b. Class: Class 1, clear.
   c. Quality: Glazing B, for general applications.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white (letter color) melamine sub core, except when other colors are indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraved with engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/16", for units up to 20 in^2 or 8" length; 1/8" for larger units.
3. Fasteners: Self-tapping stainless steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Laminated plastic, in the following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any of above criteria.
6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
7. Terminology: Include following, matching schedules as closely as possible:
   a. Name and plan number.
   b. Equipment service.
   c. Design capacity.
   d. Other design parameters such as pressure drop, entering and leaving conditions and rpm.

8. Size: Approximate 2½" by 4" for control devices, dampers and valves; and 4½" by 6" for equipment.

O. Plasticized Tags: Pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing.

1. Size: Approximately 3¼" by 5-5/8".
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary wording such as "DANGER," "CAUTION" or "DO NOT OPERATE."

P. Lettering and Graphics: Coordinate names, abbreviations and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same name are indicated, identify individual system number as well as service (such as Boiler No. 3, Air Supply No. 1H or Standpipe F12.)

PART 3 - EXECUTION

3.1 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: Complying with ASME A13.1.
2. Plastic markers, with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.
    a. Fasten markers on pipes smaller than 6” by one of following methods:
        1) Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
        2) Adhesive lap joint in pipe marker overlap.
        3) Laminated or bonded application of pipe marker to pipe (or insulation).
        4) Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than ¾” wide, lapped 1½” minimum at both ends of pipe marker, and covering full circumference of pipe.
    b. Fasten markers on pipes 6” and larger by one of following methods:
        1) Laminated or bonded application of pipe marker to pipe (or insulation).
        2) Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2” wide, lapped 3” minimum at both ends of pipe marker and covering full circumference of pipe.
        3) Strapped to pipe (or insulation) with manufacturer's standard stainless steel bands.

3. Locate pipe markers and color bands as follows wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
    a. Near each valve and control device.
    b. Near each branch connection, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
    c. Near penetrations through walls, floors, ceilings or enter non-accessible enclosures.
    d. At access doors, manholes and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.
    f. Spaced at a maximum of 50’ intervals along each run. Reduce intervals to 25’ in congested areas of piping and equipment.
    g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Valve Tags: Install valve tag on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shut-off valves, faucets, convenience and lawn-watering hose bibbs, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.

1. Install mounted valve schedule in each major equipment room.

C. Equipment: Install engraved plastic laminate signs or equipment markers on or near each major item of mechanical equipment. Provide signs for following general categories of equipment:

1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. Meters, gages, thermometers and similar units.

3. Fuel-burning units including boilers, furnaces, heaters, stills and absorption units.
4. Pumps, compressors, chillers, condensers and similar motor- driven units.
5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.
6. Tanks and pressure vessels.
7. Strainers, filters, humidifiers, water treatment systems and similar equipment.

D. Optional Sign Types: Stenciled signs may be provided instead of engraved plastic, at Installer's option, where lettering larger than 1" high is needed for proper identification because of distance from normal location of required identification.

1. Lettering Size: Minimum ¼" for name of unit where viewing distance is less than 2', ½" for distances up to 6', and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to ¾ of size of principal lettering.
2. Terms on Signs: In addition to name of identified unit distinguish between multiple units, indicate operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

E. Plasticized Tags: Install within concealed space to reduce amount of text in exposed sign (outside concealment), where equipment to be identified is concealed above acoustical ceiling or similar concealment.

1. Identify operational valves and similar minor equipment items located in unoccupied spaces (including machine rooms) by installing plasticized tags.

3.2 ADJUSTING AND CLEANING

A. Relocate mechanical identification materials and devices which have become visually blocked by work of this Division or other Divisions.

END OF SECTION 230554

SECTION 230593 - DUCT TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Test, balance and adjust air duct systems as described in Contract Documents

1.3 SYSTEM DESCRIPTION

A. Performance Requirements

1. The air distribution systems shall be balanced by a Balancing or Engineering Firm with five years' experience in HVAC design and balancing. The report shall be stamped by a licensed engineer and certified by NEBB or AABC. The Balancing firm shall furnish the necessary instruments for making tests and performing work. The Mechanical Contractor shall include in his contract all costs including the Balancing Firm's charges.
2. Noise level shall not exceed PNC 35for all supply and return air outlets and inlets when all mechanical equipment is operating.

1.4 SUBMITTALS

A. Quality Assurance/Control

1. Four copies of complete test data for evaluation and approval.
2. Test and Balance Report
    a. Complete with logs, data, and records as required herein. Print logs, data and records on white bond paper bound together in report form.
    b. Certified accurate and complete by Balancing Agency's certified test and balance engineer.
    c. Contain following general data in format selected by Balancing Agency.
        1) Project Number
        2) Project Title
        3) Project Location
        4) Project Architect and Mechanical Engineer
        5) Test and Balance Agency and Certified Engineer
        6) Contractor and mechanical sub-contractor
        7) Dates tests were performed
        8) Certification Document
        9) Report forms similar to AABC standard format
    d. Report shall include following
        1) Preface suggesting abnormalities and problems encountered.

2) Instrumentation list including type, model, manufacturer, serial number, and calibration dates.
3) System Identification reporting location of VAV boxes, zones, supply, return and exhaust openings.
4) Record following for each piece of air handling equipment.
    a) Manufacturer, model number and serial number.
    b) Design and manufacturer rated data.
    c) Actual CFM
    d) Suction and discharge static pressure of each fan.
    e) Outside-air and return-air total CFM
    f) Actual operating current, voltage, and brake horsepower of each fan motor.
    g) Final RPM of each motor.
    h) Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
    i) Belt size and quantity.
    j) Static pressure controls final operating set points.

3. Bind approved copy of report in Operations and Maintenance Manual for Division 23

1.5 QUALITY ASSURANCE

A. Qualifications

1. Work of this Section shall be performed by independent Air Testing and Balance Agency specializing in testing and balancing of heating, ventilating, and cooling systems to balance, adjust and test air moving equipment, air distribution and exhaust systems.
2. Agency shall provide proof of having successfully completed at least five years of specialized experience in air and hydronic system balancing. Work by his agency shall be done under direct supervision of qualified heating and ventilating engineer employed by Agency
3. Agency shall be approved in writing by Architect.
4. Neither Architect's engineering consultant nor anyone performing work on this Project under other Sections of Division 23 shall be permitted to do this work.

1.6 SCHEDULING

A. Award test and balance subcontract to Agency upon receipt of Notice to Proceed to allow Agency to schedule this work in cooperation with other Sections involved and to comply with completion date.

B. During construction, Agency shall inspect installation of pipe systems, sheet metal work, temperature controls, and other component parts of mechanical systems, perform inspections as follows.

1. One inspection when 60% of ductwork is installed
2. One inspection when 90% of equipment is installed.

C. Do not begin air testing and balancing until

1. After completion of air cooling, heating, and exhaust systems including installation of specialties, devices, and new filters.
2. Proper function of control system components including electrical interlocks, damper sequences, air, and water reset, and fire and freeze stats has been verified.

3. Automatic temperature controls have been calibrated and set for design operating conditions.
4. Verification of proper thermostat calibration and setting of control components such as static pressure controllers and other devices that may need set points changed during process of balancing system

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 TEST AND BALANCE COMPANIES

A. Approved Companies

1. Environmental Engineers
2. Florite
3. Building System Technologies
4. Felthouse Balancing
5. Danis Test and Balancing
6. Bonneville Test & Balance LLC
7. BTC Services
8. Certified Testing & Balancing, Inc.
9. Independent Test and Balance
10. QT&B LLC
11. Test & Balance, Inc.
12. RS Analysis Inc.
13. Diamond Test and Balance
14. Tempco Services, LLC
15. Testing company shall submit experience and history 14 days before bid day for approval.

3.2 PREPARATION

A. Heating, ventilating, and cooling systems, and equipment shall be in full operation and continue in operation during each working day of testing and balancing.

3.3 FIELD QUALITY CONTROL

A. Site Tests

1. If requested, conduct tests in presence of Architect.
2. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
3. Air Testing and Balancing Procedure
    a. Perform tests at high and low speeds of multi-speed systems and single speed systems, Perform following testing and balancing functions in accordance with Associated Air Balance Council National Standards.
        1) Fan Speeds
            a) Air Handling Units (with variable pitch pulleys and sheaves) Test and adjust fan RPM to achieve design CFM requirements.

b) Furnaces and Fan Coil Units (with direct drive motors) Set fan speed to lowest possible setting that will achieve design CFM requirements. Adjust down from Contractor setting, if necessary.

2) Current and Voltage: Measure and record motor current and voltage
3) Pitot-Tube Traverse: Perform pitot-tube traverse of main supply and return ducts to obtain total CFM
4) Outside Air: test and adjust system minimum outside air by pitot-tube traverse.
5) Static Pressure: Test and record system static pressures, including suction and discharge static pressure of each fan.
6) Air Temperature: Take wet and dry bulb air temperatures on entering and leaving side of each cooling coil. Dry bulb temperatures shall be taken on entering and leaving side of each heating unit.
7) Zone ducts: Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.
8) Main Ducts: Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
9) Branch Ducts: Adjust branch ducts to within design Cfm requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
10) Tolerances: Test and balance each diffuser, grille, and register to within 10% of design requirements.
11) Identification: Identify the location and area of each grille, diffuser, register and terminal box. Record on air outlet data sheets.
12) Description: Record size, type, and manufacturer of each diffuser, grille and register on air outlet data sheets.
13) Terminal Boxes: Set volume regulators on terminal boxes to meet design maximum and minimum CFM requirements. Check temperature controls for proper operation and calibration. Read out diffusers connected to terminal boxes shall be read out in heating and cooling modes and record their readings on air outlet data sheets.
14) Drafts: Adjust diffusers, grilles, and registers to minimize drafts.

b. Permanently mark all outside air, supply air, and return air damper positions after balancing has been completed.

4. Smoke testing, or some other approved means, may be required to determine leak locations if air balance report indicates that any system's CFM total is less than 10% of design CFM. Prior to test, verify that system's duct joints have been sealed as specified and that air moving device in question is supplying required design system air flow. Architect will approve test method required. If smoke test is selected, use following procedure. Provide necessary precautions to protect those performing or observing test from being exposed to smoke.
   a. Use zinc chloride smoke candles, titanium tetrachloride ampules or sticks, or other devices acceptable to Architect to generate smoke.
   b. Close openings in duct except for one opening at farthest end of duct run.
   c. Circulate smoke at pressurized condition of ½" minimum water gauge static pressure.
   d. Report findings to Architect in writing.

B. Final Inspection and Adjustments

1. System shall be balanced, and reports submitted to Architect before final inspection.

2. Balancing Agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two copies of air balancing test report.
    a. Architect will choose and direct spot balancing of one zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire building. If recheck testing demonstrates measured flow deviation of 10% or more from recorded information on report, report will be rejected and new inspection and report will be made and resubmitted.
    b. Perform re-balancing in presence of Architect and subject to its approval.
    c. If re-balancing is required, submit revised air test and balance reports to architect before Substantial Completion.
    d. Spot balance and re-balance shall be performed at no additional cost to Owner.

3. Where furnace supplied to job site provides over 5% more air than schedule requirements, rooms supplied by that furnace shall have their supply air quantities increased by ratio of actual total air quantity supplied to minimum air quantity required by furnace schedule.

END OF SECTION 230593

SECTION 230713 - DUCTWORK INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section 230713 - Acoustical insulation inside air ducts.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install insulation on air ducts outside building insulation envelope as described in Contract Documents.
2. Furnish and install insulation on supply, exhaust, return, and fresh air ducts and combustion air ducts within building insulation envelope.
3. Furnish and install insulation on other air ducts where indicated on Drawings.

PART 2 - PRODUCTS

2.1 INSULATION

A. 1” thick fiberglass with aluminum foil scrim Kraft facing and have a density of 1 lb/ft^3. (R-Value = 6.0) for inside building envelope.

B. 2” thick fiberglass with aluminum foil scrim Kraft facing and have a density of 1.5 lb/ft^3. (R-Value = 12.0) for outside building envelope

C. Approved Manufacturers.

1. Manville Microlite FSK
2. CSG Type IV standard duct insulation
3. Owens-Corning FRK
4. Knauf (Duct Wrap FSK)
5. Certainteed Standard

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct wrap in accordance with Manufacturer's recommendations (overlap insulation 4”).

B. Do not compress insulation except in areas of structural interference.

C. Completely seal joints.

END OF SECTION 230713

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Division-01 Specification Sections, apply to work of this section.

1.2 SUMMARY

A. Section in includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section “General Commissioning Requirements” for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC & R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean “as-built” systems, subsystems, equipment, and components.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates of readiness

B. Certificates of completion and installation, prestart, and start up activities.

1.5 ALLOWANCES

A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the “Schedule of Allowances” Article in Division 01 Section “Allowances.”

1.6 UNIT PRICES

A. Commissioning testing allowance may be adjusted up or down by the “List of Unit Prices” Article in Division 01 Section “Unit Prices” when actual man-hours are computed at the end of commissioning testing.

1.7 CONTRACTOR’S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the Engineer.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC & R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by Engineer.

E. Provide information requested by Engineer for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.8 COMMISSIONING OF DOCUMENTATION

A. Provide the following information to Engineer for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC & R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC & R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC & R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC & R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by Engineer.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing work, provide copies of reports, sample forms, checklists, and certificates to Engineer.

B. Notify Engineer at least 10 days in advance of testing and balancing work, and provide access for Engineer to witness testing and balancing work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of Engineer.

1. Engineer will notify testing and balancing contractor 10 days in advance of the date of the field verification. Notice will not include data points to be verified.
2. The testing and balancing contractor shall use the same instruments (by model and serial number) that were used when original data was collected.
3. Failure of an item includes, other than sound, a deviation of more than 10%. Failure of more than 10% of selected items shall result in rejection of final testing, adjusting and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify Engineer so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the engineer.

B. Scope of HVAC & R testing shall include entire HVAC & R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Engineer along with the HVAC & R subcontractor, testing and balancing subcontractor, and HVAC & R instrumentation and control subcontractor, shall prepare detailed testing plans, procedures, and checklists for HVAC & R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated condition may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by engineer and document simulated conditions and methods of simulation. After test, return settings to normal operating conditions.

G. Engineer may direct that set points be altered when simulating conditions is not practical.

H. Engineer may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC & R system, document the deficiency and report it to the engineer. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC & R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 23 boiler sections. Provide submittal, test data, inspector record, and boiler certification to engineer.

B. HVAC & R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections “Instrumentation and Control for HVAC” and “Sequence of Operations for HVAC Controls.” Assist engineer with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping sections. HVAC & R subcontractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final report to engineer. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. Engineer shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. HVAC & R Distribution System of Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC & R terminal equipment and unitary equipment.

F. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION 230800

SECTION 230900 – DDC SYSTEM SPECIFICATIONS

PART 1 - SYSTEM OVERVIEW

A. DDC CONTROL SYSTEM

1. Statement of Intent

The intent of this specification is to provide a high-quality Direct Digital Control system with Web based software front end and top-of-the-line control hardware. System is to include a Graphical User Interface (GUI) residing on a WebServer accessible with an industry standard non-proprietary Web Browser. Connectivity shall be over the owner's internal Ethernet system and, when allowed, over the Internet using the servers IP address. Connection to the WebServer software shall be thin client access and shall not require that the browser device have special software or applets for access. If connection to an Intranet or to the Internet is not available on initial installation, the server shall be accessed via a web browser locally hosted on the server. The graphic user interface shall display real time values of all system operating conditions. Additionally, it shall include graphic displays of system programming, operating logic and logic flow. It shall display logic flow with real time values of logical inputs and outputs. This graphical display capability is required for system diagnostics of both the mechanical systems controlled by the DDC system and of the operating logic and sequences themselves. The features of the system must be fully installed, configured and demonstrated in a manner that provides maximum benefit to the end user.

2. Specification Compliance
These specifications are intended to provide minimum capability for the DDC system. Manufacturer's data sheets included in the submittals will be reviewed to verify significant hardware and software system features. Key system features must be documented by manufacturer's data sheets in the submittals or by demonstration of an existing installation.

3. Approved DDC Contractor and System
DDC Control System shall be:
WebCTRL by Automated Logic Corporation
No Substitution

B. SCOPE OF WORK
Refer to the matrix at the end of this specification that shows the scope of responsibility for the various trades:

1. Control Hardware and Software
The Automatic Temperature Control (ATC) Contractor shall be responsible for furnishing and installing all control hardware and software necessary for a complete DDC control system as specified. ATC contractor shall furnish all modules, temperature sensors, flow sensors, humidity sensors, IAQ sensors, control valves, control valve actuators, dampers, damper actuators and any other items necessary for a complete system and sequence of control, except those valves, dampers and actuators specified to be furnished by equipment supplier. When actuators are specified to be furnished by equipment supplier, that supplier shall be responsible for coordination of actuator control input for interface with DDC system without use of transducers. Automatic control valves, dry wells for fluid temperature sensors, dampers and actuators shall be installed by the mechanical contractor.

Specifically the ATC Contractor shall furnish the following:

a. Individual unitary control modules for each unitary system:

Split system air handlers and condensing units
Unitary package rooftop units
Fan coils

b. Individual control modules for all non-unitary air handlers or package units:

Restroom exhaust fans
Constant volume air handling units
Variable air volume air handlers

c. General purpose modules for control of central fan, pump, boiler, or heat pump condensing unit operation:

Outdoor Air Conditions
Fire Alarm Monitor

d. Required peripheral mechanical components to be furnished by ATC contractor:

Zone damper actuators
Economizer damper actuators not specified as part of mechanical equipment

e. Required non-HVAC controls to be furnished by ATC contractor:
None

f. Required software integration to other digital control systems:
None

2. Control Wiring and Interface to Line Voltage Control
ATC Contractor shall be responsible for control wiring to all control modules, sensors, pilot duty control relays and actuators required to provide Sequences of Operation as noted in Part 5. ATC contractor shall provide control interface to boilers, heat pumps, pumps and fans. This shall include pilot duty relays where interface to line voltage switching devices is required. ATC Contractor shall provide all required conduit for low voltage wiring within mechanical rooms or at equipment locations unless specifically shown on Division 16 drawings. Electrical Contractor shall provide all required conduit for line voltage wiring, all contactors, magnetic starters and motor control centers required for operation of mechanical systems except where specifically noted to be provided by equipment manufacturer. *Electrical contractor shall furnish conduit where required between the zone temperature sensor locations and the zone equipment. The Electrical Contractor shall also be responsible for line voltage circuits and connection to ATC panels.*

Unitary equipment will be supplied with required fan relays, compressor contactors, electric heat sequencers and transformer ready for connection to ATC provided control modules.

3. Control Integration with Third Party Digital Controls Supplied by Others
Automatic Temperature Control (ATC) Contractor shall be responsible for all programming of controls furnished by them to accomplish the required integration. ATC Contractor shall provide necessary hardware to maintain these programs. Local area network wiring required for connection to interface hardware provided under the ATC project scope is the responsibility of the ATC Contractor. If Ethernet connection to third party controls is

required, that network connection shall be the responsibility of others.

Suppliers of equipment that is required to be integrated with the DDC system shall be responsible to coordinate integration software protocol and connectivity with ATC Contractor prior to bid to insure satisfactory integration and system operation. Equipment suppliers are required to confirm that their factory installed controls are capable of achieving sequences of operation listed under this section, and that required points are available to the DDC system. If specified sequences cannot be met with factory installed controls the equipment supplier shall be responsible for furnishing and installing required external controls or peripheral devices. Any required communication wiring between digital control devices provided by equipment suppliers shall be the responsibility of that supplier. This may be under separate agreement with the ATC Contractor.

Equipment suppliers shall provide complete points list including Usage Description, Addresses and Device ID numbers, and network number if applicable.

Acceptable protocols:
Variable Frequency Drives, lighting systems or power monitoring systems shall use either Modbus or BACnet software protocols for integration to this DDC system.

4. Commissioning
   ATC Contractor shall be responsible for self-commissioning of all hardware and software programming furnished with the project. Completed point checkout commissioning sheets shall be included with the final "as-built" O&M manuals. These sheets shall include validation check fields for each physical and software or network input and output, with date and time of verification and initials of individual preforming the checkout. Physical point checkout lists shall include check offs for point type, address, scaling range, and any calibration offset. Software point checkout lists shall include check offs for mapped address and communication verification. Point checkout lists shall use logical names for future reference by the owner.

   Each graphic file will be checked for visual accuracy and to verify that point mapping on those files is correct. Each unique operating program shall be functionally tested to confirm that operation conforms to the Sequence of Operation. Documentation of graphic commissioning and Functional Performance Testing shall be included in the project O&M manuals.

5. Training and Technical Support
   Contractor shall provide 24 hours of factory approved classroom training for owner representatives on operation and servicing of the automatic temperature control system. Training shall be oriented to make the owner self-sufficient in the day to day use and operation of the DDC system. Additionally, the training shall include information specifically focused on showing the owners representative methods for troubleshooting the mechanical systems using the DDC system. For this purpose, the trainer must be well grounded in both DDC system operation and in mechanical systems service.

   Classes shall be given at a location remote from the student's place of work to minimize distractions. Classes shall be scheduled multiple times during the first year to allow flexibility for Owner's representative to attend. Tuition to these classes shall be included within the scope of this project. If course locations are more than 200 miles from the project site, cost of transportation, lodging and meals shall be included within the scope of this project.

   The contractor shall provide unlimited phone technical support to the owner's representative during the one year warranty period. If the technical support location of the contractor is outside of the toll free calling area for the customer, the contractor shall have a toll free

number or accept collect calls for the purpose of providing technical support.

6. SUBMITTALS AND O&M MANUALS

   a. Submittals
   Submittals shall include the following sections:

      i Shop Drawings with:
      Title Page
      Table of Contents
      Typical Device Wiring Drawings
      Summary Bill of Materials
      Sequences of Operation
      Local Area Network Drawings
      Drawings for all operating systems showing both equipment and module connections
      Bill of Materials Specific to Each Drawing

      ii Manufacturer's specification data sheets for all:
      control modules
      sensors
      dampers
      valves
      actuators
      flow switches
      current sensors
      transducers

      If the contractor wishes to substitute any item after approval of submittal they shall submit appropriate data sheets for approval before including substituted product on the project.

   b. O&M Manuals
   O&M Manuals shall be furnished upon project completion and include technical instructions for all items originally included in the submittal with "as built" modifications and completed Commissioning Worksheets. O&M Manuals shall be in a separate three ring binder. Contractor's toll free technical support number or the words "Call Collect" with the contractor's regular phone number shall be on the front of the manual.

7. SYSTEM SOFTWARE
   System Software shall include the following:
      DDC operating system
      Any software required for control logic programming
      Any software required for graphics generation
      Any other software used to create a fully functional system
      Site specific database

   All software programs shall be installed on the owner's server.

   All licenses shall become the property of the Owner

Part 2 CONTRACTOR CAPABILITY

1. Contractor shall maintain toll-free technical support phone line or accept collect phone calls during warranty period.

2. Contractor shall provide service within 24 hours.
3. Contractor service and installation technicians shall be technically proficient in both control systems and mechanical service.

Part 3 HARDWARE

A. SYSTEM SERVER

Software shall be installed on existing Automated Logic Front-end server.

B. FIELD HARDWARE

1. BACnet

The system shall be fully native BACnet at the time of installation. The system shall use BACnet as the native communication protocol between distributed controllers communicating on the controller network (i.e. Field Bus) and must, as a minimum, support the following Objects and Application Services (Conformance Class 3):

Objects >	Binary Input	Services >	Read property
	Binary Output		Write property
	Binary Value		I-Am
	Analog Input		I-Have
	Analog Output		Read Multiple Property
	Analog Value		Write Multiple Property
	Calendar		Who-Has
	Schedules		Who-Is

2. Distributed Control

System shall observe the concept of distributed control. All modules shall have "stand alone" capability and shall maintain operator set points without connection to primary controllers or central station equipment. Modules shall be located at each operating equipment location such that individual systems or zones shall remain functional without communication to other systems on the network. Equipment operating logic, schedules and current trends shall reside in control modules serving each system. Use of global modules required to maintain programming, schedules or current trend data are not acceptable.

3. Ethernet Gateway Routers

System shall include an Ethernet Router/Gateway between the control module network and owners Ethernet. This gateway shall route BACnet communications between the control module network and the owners IP network. If the system is not to be connected to the customer's Ethernet the gateway shall be capable of connection via a web browser on the local host server.

4. Control Modules

a. Control modules shall include required inputs and outputs to meet sequence of operation and points list. Digital outputs shall be dry contact relays and analog outputs shall be industry standard 0-10 vdc, 2-10 vdc or 4-20 milli-amp. Triac digital outputs are not acceptable.

b. Modules shall be fully programmable for maximum system flexibility. Application specific controllers are not acceptable.

c. All modules shall have battery backup capable of maintaining all programs, set points, schedules, and trend information for a minimum of 7 days.

d. All schedules and current trends shall be maintained in the individual control modules. The modules shall be capable of maintaining sufficient trend samples to report 24 hours of trend history in 5 minute increments for each input or output.

e. Control Modules shall communicate via BACnet over either:

i ARCnet at a speed of 156k baud
ii MS/TP at a speed of 76.8k baud
iii ARCnet systems shall also be capable of supporting slower MS/TP communications buss when required for interface to other BACnet devices.

5. Temperature Sensors (analog)

a. Wall mounted zone temperature sensors shall be 10 k ohm thermistor.

i Zone sensors in primary occupied areas other than restrooms, hallways or storage rooms shall have set point adjustment to allow the occupants to raise or lower the set point within operator defined parameters. Additionally, sensors in these primary areas shall have a push button to return the system to normal occupancy set points for an operator defined period. Exception will be common areas.

ii Zone sensors for restrooms, hallways, storage rooms, gymnasiums, auditoriums and locker rooms shall be mounted on the back of an aluminum electrical box cover plate designed for zone sensing application.

iii Gymnasium sensors shall also include a key access override feature.

b. All other temperature sensors shall be industry standard thermistor or 4-20 milli-amp.

c. Minimum of two outside air sensors are required for each facility and software programmed to use the lower temperature of the two for any control logic that uses OAT.

d. Immersion sensors shall be mounted in a blind well for future serviceability.

6. AHU Freeze Protection Thermostats (binary)

a. All Air Handling Units with outside air and Heating Water, Chilled Water, Condenser Water or Steam coils shall have a manual reset binary freeze protection thermostat installed downstream of each coil. Exceptions shall be made when water circuits are protected with glycol.
b. Freeze protection thermostats shall be wired to directly open the control circuits for the fans. Control module outputs for freeze protection shall only be used for redundancy.

c. An auxiliary switch on the freeze protection shall be wired to the AHU control module for alarming and additional control actions.

7. Current Transformers

a. Current transformers used for fan status on belt drive constant volume air handlers shall be adjustable type. These shall be calibrated to indicate fan failure on belt loss.

b. Current transformers used for pump status on pumps larger than 1 horsepower shall be adjustable type. These shall be calibrated to indicate pump failure when the pump cavitates on flow loss.

c. Current transformers used for fan status on variable frequency drives shall be analog type. Software should note max flow amperage. Equipment program will indicate fan loss if amp draw drops below 60% of max flow amperage and software requests drive speed above 50 hz.

8. Pressure Sensors (analog)

a. Duct pressure sensors used for control of variable air flow air handling units shall be located in the longest duct run approximately 2/3 of the total duct length from the AHU.

b. Building pressure sensors used for control of outside or relief air shall have more than one OA pressure reference point to minimize wind effects. OA pressure pickup shall be protected against blockage by insects.

c. Hydronic pressure sensors used for control of variable flow pumps shall be located across a unit without a two way valve and pressure differential set 1.5 times the design pressure drop across that unit.

9. Hi Pressure Safety (binary)

a. Variable air flow air handling units shall have a manual high static pressure safety located at the AHU outlet to provide safety shut down if pressure exceeds 5" for more than 30 seconds. Variable frequency drives should be programmed for soft start to prevent nuisance tripping on startup.

10. Valve and Damper Actuators

a. Actuators shall be manufactured by Belimo.

b. Torque shall be rated 20% above required load.

c. Modulated actuator input shall be industry standard 0-10 vdc, 2-10 vdc, 4-20 milli-amp, floating motor (tri-state), or pulse width modulation. Two or three position operation is not acceptable for economizers, VAV dampers, multi-zone dampers, valves or any other application where modulated operation is specified.

d. Damper actuators used on any damper where one side is exposed to outside air shall have spring return to close dampers upon loss of power.

e. Valve actuators used on any Heating Water Valve shall have spring return to open valve upon loss of power.

f. Valve actuators used on any Steam Valve shall have spring return to close valve on loss of power.

11. Dampers

a. Any damper where one side is exposed to outside air shall have neoprene or vinyl-grip blade seals, stainless spring steel edge seals and a specified leakage rate of not more than 65 CFM/damper face area at 2" W.G. static pressure drop. Exception will be combustion intake dampers and air to air heat exchange relief dampers.

b. When outside air intake dampers for economizers are furnished by ATC Contractor those dampers shall be opposed blade style.

c. Individual damper blades shall not exceed 48”.

12. Wire

a. All wiring in open areas at heights below 12 feet must be run in conduit.

b. Control wiring may be run open in accessible ceiling or under floor areas.

c. Control wiring in non-accessible ceilings, walls or floors shall be in conduit.

d. All wiring not in conduit or control cabinets shall be rated for plenum installation.

e. Communication wiring shall be run in data cable tray whenever possible.

Part 4 SOFTWARE

A. MULTIPLE OPERATING PLATFORMS

The front end server software furnished as a part of the DDC system shall be capable of operating on multiple operating systems such as Microsoft Windows, Linux or Sun Solaris.

B. MULTI-BROWSER ACCESS

Internet, Intranet or Local Host access to the system shall be via thin client browser access using any standard browser, such as Internet Explorer, Firefox or Chrome

C. GRAPHICAL PROGRAMMING

The system shall be programmed using a graphical programming language for ease of operator understanding. Operating sequences and logic flow shall be assembled in a schematic format using visually descriptive micro-blocks or icons representing inputs, outputs, and logical functions such as and/or logic, set points, switches, limits, relays, PIDs etc. The programming software shall be furnished within this scope of work.

Full simulation capability shall also be provided with the graphic programming. User shall be able to fully simulate the constructed sequence on screen before the sequences are downloaded into the controllers. The system shall also include the ability to simulate multiple graphic programs communicating with each other on a simulated network.

D. GRAPHICAL INTERFACE SOFTWARE

1. System and Equipment Graphics

The operator’s interface software shall be graphics based and display in 256 colors at a minimum 1024 x 768 pixel resolution. Graphics display screens shall include a system level graphic of either a map of facilities or an elevation of the building, a graphic of each building floor plan and graphics for each operating system or unit within each building. Entry to the zone and equipment level interface graphics shall be through area maps and/or floor plans to facilitate user orientation. Additionally the system hierarchy shall be displayed in a fashion similar to Windows Explorer to enable the user to navigate to any graphical screen in the system by expanding building levels or floor levels and selecting a particular zone or system. Graphics shall be accessed by using a mouse or other pointer device. The system shall provide a visual indication of which building, floor and zone the user is accessing at any time. System shall be capable of changing all parameters and schedules, as well as downloading operating software from the same Graphical User Interface software program as that used for viewing system operation.

Thermal graphic floor plans shall display each temperature zone in a color appropriate to current space temperature conditions. The system shall display in 8 separate colors the following conditions: High or low temperature alarm, temperature at set point, cooling call, heating call, more than 2° above set point, more than 2° below set point, unoccupied between set points and no communication. Floor plans shall also include color graphic indicators for non-zone specific mechanical equipment operation showing On/Off and Alarm Conditions. Status indication colors shall be updated dynamically as conditions change.

Mechanical equipment pictorial graphics shall be displayed by the use of point-and-shoot selection using a mouse or other pointer device. Graphics shall be provided for all mechanical equipment and devices controlled by the DDC system. These graphics shall provide a current status of all I/O points being controlled and applicable to each piece of equipment including analog readouts in appropriate engineering units at appropriate locations on the graphic representation.

2. Graphical Screen Replay
   The system shall have the ability to replay up to 24 hours of thermal graphic floorplans, equipment graphics, alarms or trend pages, starting at a specified date and time as a troubleshooting tool.

3. Software Graphic Programming Live User Interface
   The system shall be able to display the graphic displays of system programming, operating logic and logic flow with real time conditions displayed at each input, output and logical function. This display will allow the operator to observe each step of a control logic process and facilitate system software troubleshooting. Operator shall have the ability to select any mirco-block in the graphical program to change parameters including the ability to lock values.

E. FACILITY MANAGEMENT AND ENERGY MANAGEMENT FUNCTIONS

1. Scheduling

   a. For maximum flexibility, schedules shall reside in the local control modules. Systems that rely on Central Control Modules for scheduling are not acceptable.

   b. Schedules shall be at the zone level. Central plant or fan operations shall not be scheduled, rather they shall run based on requests from the zones that they serve.

   c. The DDC system shall have the ability to schedule each individual zone, each building or floor or the entire network of buildings for any user with a single entry. Additionally the operator shall have the capability of assembling groups of zones, buildings or floors for single entry programming, e.g. several classrooms or offices may be grouped for scheduling of Saturday operations.

   d. Available schedule types shall include normal operation, unoccupied operation, setback override and holidays.

   e. Dated schedules shall be self-managing and automatically delete after execution.

2. Demand Control

   The system shall have the ability to receive an analog or digital input of electrical usage/demand through any open input on a general purpose module. If demand control is implemented in the future, this capability shall not require any additional DDC hardware

except the single input point and, when implemented, the digital or analog devices required to read electrical demand levels.

The system shall be capable of rotating greater or lower demand levels every 10 minutes to alternate zones throughout the facility to minimize long term set point offset.

3. Interactive Operations
   The system shall have the ability to send run requests, heating requests and cooling requests from one module to another for the purpose of optimizing run operations of central plant equipment. Additionally the system shall be capable of limiting operation of various equipment if another mechanical point elsewhere in the system allows that operation. e.g. a boiler loop circulating pump shall run only when requested by a zone requiring heating operation and will shut down during hours that zone demand is satisfied.

4. Enterprise Integration
   The system shall be capable of exchanging web services (via XML/SOAP) information with other Enterprise servers for the purpose of optimizing system operation, e.g. obtaining NOAA Weather Service for optimizing night purge operation, or for the purpose of providing information to other Enterprise servers to optimize other building information systems, e.g. providing maintenance notifications to an Enterprise based facilities maintenance software.

   The software to enable this interface shall be provided and fully operational within the scope of this project.

5. Energy Reporting Tools
   System shall include an easily configured energy reporting tool that provides the capabilities described in this section. This reporting software shall be resident on the customer server and shall not have any additional subscription support cost.

   a. The energy reporting tool shall:

      i be accessible through the same user interface (Web browser or operator workstation software) that is used to manage the BAS.
      ii be preconfigured by the Contractor to gather and store energy demand and consumption data from each energy source that provides metered data to the BAS. Meter data shall be stored at 5 minute intervals unless otherwise specified in the Sequence of Operation below. This data shall be maintained in an industry standard SQL database for a period of not less than five years.
      iii allow the operator to select an energy source and a time period of interest (day, week, month, year, or date range) and shall provide options to view the data in a table, line graph, bar graph, or pie chart.
      iv allow the operator to select two or more data sources and display a comparison of the energy used over this period in any of the listed graph formats, or to total the energy used by the selected sources and display that data in the supported formats.
      v allow the operator to select an energy source and two time periods of interest (day, week, month, year, or date range) and display a graph that compares the energy use over the two time periods in any of the graph formats listed in the previous paragraph.
      vi allow the operator to select multiple energy sources and display a graph that compares the total energy used by these sources over the two time periods.
      vii allow the operator to easily generate the previously described graphs "on the fly," and shall provide an option to store the report format so the operator can select that format to regenerate the graph at a future date.

viii allow the user to schedule these reports to run on a recurring basis using relative time periods, such as automatically generating a consumption report on the first Monday of each month showing consumption over the previous month.

b. System shall be capable of automatically generating reports that can be archived on the server in a common industry format such as Adobe PDF or Microsoft Excel. System shall be capable of e-mailing reports to a user editable list of recipients.

c. The energy reporting tool shall be capable of collecting and displaying data from the following types of meters:
   i Electricity
   ii Gas
   iii Potable Water
   iv Heating and cooling degree days. (May be calculated from sensor data rather than metered.)

d. The system shall be capable of using kW (kWh) or Btu/hr (Btu), or multiples of these units, e.g. MWH, kBtu, as the units for demand and consumption reports. All selected sources shall be automatically converted to the selected units. The user shall similarly have the option of entering facility area and occupancy hours and creating reports that are normalized on an area basis, an annual use basis, or an occupied hour basis.

e. Capability shall include the option of entering benchmark data for an individual facility or a group of facilities.

f. Capability shall include the option of displaying any or all of the following data on any chart, line, or bar graph generated by the energy reporting tool:
   i Low/High/Average value of the metered value being displayed.
   ii Heating and/or Cooling Degree Days for the time period(s) being displayed.
   iii The Environmental Index for the facilities and time periods being displayed.

6. Environmental Index.
   System shall monitor all occupied zones and compile an index that provides a numerical indication of the environmental comfort within the zone. As a minimum, this indication shall be based upon the deviation of the zone temperature from the heating or cooling set point. If humidity is being measured within the zone then the environmental index shall be adjusted to reflect a lower comfort level for high or low humidity levels. Similarly, if carbon dioxide levels are being measured as an indication of ventilation effectiveness then the environmental index shall be adjusted to indicate degraded comfort at high carbon dioxide levels. Other adjustments may be made to the environmental index based upon additional measurements. The system shall maintain a trend of the environmental index for each zone in the trend log. The system shall also compute an average comfort index for every building included in this contract and maintain trend logs of these building environmental indices. Similarly, the system shall compute the percentage of occupied time that comfortable conditions were maintained within the zones. Through the UI the user shall be able to add a weighting factor to adjust the contribution of each zone to the average index based upon the floor area of the zone, importance of the zone, or other static criteria.

7. ALARMS, TRENDS AND REPORTS

   a. System and Temperature Alarms
      The system shall have the capability of monitoring conditions throughout the system and sending alarms via text or messages to an e-mail address, local PC or printer or to remote PC's, printers or to dial-up pagers. Alarms and messages shall be able to be prioritized for

various levels of reporting and action. The operator shall have the ability to customize alarm text and messages.

b. Trends
The system shall be capable of trending any input or output, or any logical point within an operating program, e.g. output of a PID. There shall be no limitation to the number of points that can be trended at any particular time. Modules shall store in live memory 288 trend samples points for each trended item. The interval between trend samples shall be adjustable from 1 second to 24 hours. Trends from one or more modules shall be able to be simultaneously displayed on a single trend graph. Operator shall be able to "window" any segment of a trend to enlarge the view by dragging a mouse to form the "window". The system shall also have the ability of automatically downloading trend information from any module to the server or other computer connected to the network for historical trend storage. This trend information shall be able to be displayed on the trend graph along with live current trends in seamless fashion. Trend data collection requiring the use of a locally connected PC for data storage is unacceptable.

c. Reports
The system shall be capable of generating reports of equipment run times, all trended points, temperature conditions, electric demand and usage, and alarms or messages. The system shall also have the ability of automatically downloading report information from any module to the server or other computer connected to the network. The operator shall have the ability to create custom report and logging formats.

Part 5 SEQUENCES OF OPERATION

A. GENERAL

The following sequences of operation shall be strictly observed. All temperature set points, static pressure set points, percentage of PID output trip points and reset ratios within this specification shall be changeable by operator using the operator software furnished with the system.

B. DISTRIBUTED CONTROL

System shall observe the concept of distributed control. Modules shall be located at each operating equipment location such that individual systems or zones shall remain functional without communication to other systems on the network.

C. CENTRAL PLANT, PUMP AND FAN OPERATION

Control of all central fan systems, chillers, boilers and pumping stations shall be based on run requests, heating requests or cooling requests from zone controls. Reset of supply air static pressure, supply air temperature, chilled water temperature and hot water temperature shall be based on zone temperature conditions and heating or cooling requests from zones.

D. SCHEDULING

For maximum flexibility all occupancy schedules shall be stored in zone control modules. Central fans or pumps shall start when commanded from any associated zones that call for occupancy or for operation to meet setback heating or cooling requirements and shall not require separate scheduling unless required for the sequence of operation. Fans or pumps larger than 5 horsepower shall run for minimum of 30 min

E. Engineer/owner meeting to communicate the sequence of operation for the following equipment:

Air handlers, rooftop units, split systems, kitchen hood make-up and exhaust, gas furnace/condenser, electric heaters, and restroom exhaust fans.

END OF SECTION 237310

SECTION 231500 - ELECTRICAL PROVISIONS OF MECHANICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

C. Division 26 is considered a part of this Section.

1.2 SUMMARY

A. Includes but not limited to

1. Provide and install the mechanical equipment that requires electrical service to operate. The equipment must be fixed in place before electrical contractor can provide power there to basic electrical heating units as noted on the plans.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. The equipment is defined in the Equipment Schedule on the drawing, as to horse power watts, voltage and amperage.

B. The contractor shall confirm the specified voltage is available on site before ordering equipment. If not available contact the design engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The equipment shall be installed in strict accordance with the manufacturer’s recommendations and as detailed on the plans.

PART 4 - TESTING

4.1 OPERATIONS

A. When the equipment has been installed and electrically connect confirm operation by first jogging the equipment to prove rotation and free operation then start and with the electrician prove the name plate operating load.

B. The start-up information, voltage and amp shall be recorded.

END OF SECTION 231500

SECTION 232110 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to -

1. General piping installation procedures for all piping systems.

B. Related Sections -

1. General Conditions, Division 01, and Section 230501 apply to this Section.
2. Type of pipe and fittings specified under each piping system.

1.2 QUALITY ASSURANCE

A. Manufacturer -

1. Use domestic (USA) made pipe and pipe fittings on Project.

PART 2 - PRODUCTS

2.1 VALVES

A. Valves of same type shall be of same manufacturer.

B. Valves shall be domestic (USA) on this project.

2.2 PIPE HANGERS

A. Adjustable, malleable iron clevis type of a diameter adequate to support pipe size.

B. Approved Manufacturers -

1. B-Line Systems Fig. B3100
2. Grinnell No. 260
3. Kin-Line 455
4. Superstrut CL-710

2.3 INSULATING COUPLINGS

A. Suitable for at least 175 PSIG WP at 250/F.

B. Approved Manufacturers -

1. Central Plastics Co
2. Victualic Co
3. Watts Regulator Co

2.4 SLEEVES

A. Sleeves shall be standard weight galvanized iron pipe, Schedule 40 PVC, or 14 gauge galvanized sheet metal two sizes larger than pipe or insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.

B. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.

1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
2. Do not use pipe hooks, chains, or perforated metal for pipe support.
3. Remove burr and cutting slag from pipes. All pipe and tube shall be reamed to the full inside diameter of the pipe and tube.
4. Make changes in direction with proper fittings.
5. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
6. Support piping at 8’ on center maximum for pipe 1¼” or larger and 6’ on center maximum for pipe one inch or less. Provide support at each elbow. Install additional support as required.
7. Suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps (except underground pipe). Laying of piping on any building member is not allowed.

C. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings. Provide accessible, ground joint unions in piping at connections to equipment.

D. Make connections of dissimilar metals with insulating couplings.

E. Provide sleeves around pipes passing through floors, walls, partitions, or structural members.

1. Seal sleeves with plastic or other acceptable material.
2. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

F. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

G. Install piping systems so they may be easily drained.

H. Grade soil and waste lines within building perimeter ¼” fall per ft in direction of flow or as noted on the plans.

I. Insulate water piping buried within building perimeter.

J. Do not use reducing bushings, street elbows, or close nipples.

K. Bury water piping 6” minimum below bottom of slab and encase all water lines in PVC or ABS sleeves, a minimum of 2 pipe sizes larger than water line being encased and the insulation installed on this piping. Install 2” minimum of sand around the encasement pipe.

END OF SECTION 232110

SECTION 232300 - REFRIGERANT PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section 232315 - Refrigerant piping Insulation

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install piping for refrigeration systems as described in Contract Documents.
2. All materials and equipment specified under this section shall be American manufactured and made.

1.3 QUALITY ASSURANCE

A. Qualifications

1. Refrigerant piping shall be installed by a refrigeration contractor licensed by State.
2. All materials and equipment specified under this section shall be American manufactured and made.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Meet requirements of ASTM B 280-88, "Specification for Seamless Copper Tube for Air Conditioning & Refrigeration Field Service", hard drawn straight lengths.

B. Do not use pre-charged refrigerant lines.

C. All materials and equipment specified under this section shall be American manufactured and made.

2.2 REFRIGERANT FITTINGS

A. Wrought copper with long radius elbows.

B. Approved Manufacturers

1. Mueller Streamline
2. Nibco Inc
3. Grinnell
4. Elkhart Products Corp

2.3 SUCTION LINE TRAPS

A. Manufactured standard one-piece traps.

2.4 CONNECTION MATERIAL

A. Brazing Rods

1. Copper to Copper Connections
   a. AWS Classification BCuP-4 Copper Phosphorus (6% silver).
   b. AWS Classification BCuP-5 Copper Phosphorus (15% silver).

2. Copper to Brass or Copper to Steel Connections
   a. AWS Classification bAg-5 Silver (45% silver).

3. Do not use rods containing Cadmium.

2.5 FLUX

A. Approved Manufacturers

1. "Stay-Silv white brazing flux" by J W Harris Co
2. High quality silver solder flux by Handy & Harmon

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not install refrigerant piping underground or in tunnels.

B. Slope suction lines down toward compressor 1”/10’. Locate traps at vertical rises against flow in suction lines.

C. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary.

1. No soft solder (tin, lead, antimony) connections will be allowed in system.

D. Braze valve, sight glass, and flexible connections.

E. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

3.2 FIELD QUALITY CONTROL

A. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.

1. Draw vacuum on each entire system with vacuum pump to 300 microns using vacuum gauge calibrated in microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum. Isolate compressor from system piping using shut-off valves prior to pulling vacuum.

2. Break vacuum with Freon to be used and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without compressor running.
3. Conduct tests at 70° F ambient temperature minimum.
4. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
5. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.

END OF SECTION 232300

SECTION 232310 - REFRIGERANT PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Division 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

C. General Conditions, Division 01, and Sections 230501 and 230553 apply to this Section.

D. Section 232300 - Refrigeration piping

E. Section 236213 - Expansion valves for 2 through 5 ton condensing units

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install refrigeration specialties as described in Contract Documents except for expansion valves on 2 through 5 ton condensing units.
2. All materials and equipment specified under this section shall be American manufactured and made.

PART 2 - PRODUCTS

2.1 EXPANSION VALVES:

A. For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.

B. Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.

C. Approved Manufacturers

1. Alco
2. Henry
3. Mueller
4. Singer
5. Sporlan

2.2 FILTER-DRIER

A. On lines ¾” outside diameter and larger, filter-drier shall be replaceable core type with non-ferrous casing and Schraeder type valve.

B. On lines smaller than ¾" outside diameter, filter-drier shall be sealed type using flared copper fittings.

C. Size shall be full line size.

D. Approved Manufacturers

1. Alco
2. Mueller
3. Sporlan
4. Virginia

2.3 SIGHT GLASS

A. Combination moisture and liquid indicator with protection cap.

B. Sight glass shall be full line size.

C. Sight glass connections shall be solid copper or brass, no copper-coated steel sight glasses allowed.

D. Approved Manufacturers

1. Alco
2. Asco
3. Mueller
4. Sporlan

2.4 MANUAL REFRIGERANT SHUT-OFF VALVE

A. Ball valves designed for refrigeration service and full line size.

B. Valve shall have cap seals.

C. Valves with hand wheels are not acceptable.

D. Provide service valve on each liquid and suction line at compressor.

E. If service valves come as integral part of condensing unit, additional service valves shall not be required.

F. Approved Manufacturers

1. ConBraCo (Apollo)
2. Henry
3. Mueller
4. Superior
5. Virginia

2.5 FLEXIBLE CONNECTORS

A. Provide in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons.

B. Anchor pipe near each flexible connector.

C. Connectors shall be for refrigerant service with bronze seamless corrugated hose and bronze braiding.

D. Approved Manufacturers

1. Packless Vibration Absorbers Model VAF
2. Style "BF" Spring-flex Freon connectors by Vibration Mountings.
3. Anaconda "Vibration Eliminators" by Anamet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.

END OF SECTION 232310

SECTION 232315 - REFRIGERANT PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve as described in Contract Documents.

PART 2 - PRODUCTS

2.1 FLEXIBLE FOAMED PIPE INSULATION

A. Thickness

1. 1½” for all pipe diameter.

B. Approved Manufacturers

1. Armaflex
2. Rubatex
3. CSG "Ultrafoam"
4. IMCOA "ImcoLock"

2.2 JOINT SEALER

A. Approved Manufacturers

1. Armaflex 520
2. BFG Construction Adhesive #105
3. Therma-Cel 950.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.

B. Stagger joints on layered insulation.

C. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.

D. Seal joints in insulation. Use black nylon 1" tie straps every 2’.

E. Insulate flexible pipe connectors.

F. Insulate thermal expansion valves with insulating tape.

G. Insulation exposed outside building shall have "slit" joint seams placed on bottom of pipe.

H. Insulate fittings with sheet insulation and as recommended by Manufacturer.

I. Paint exterior exposed insulation with two coats of white or gray finish recommended by Insulation Manufacturer, except on Therma-Cel insulation.

END OF SECTION 232315

SECTION 233114 - LOW-PRESSURE STEEL DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section 230593 - Smoke testing

D. Section 233123 - Underground Ductwork

E. Section 233115 - High Pressure Ductwork

F. Section 230934 - Temperature control damper actuators and actuator linkages

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install above-grade ductwork and related items as described in Contract Documents.
2. All materials and equipment specified under this section shall be American manufactured and made.

PART 2 - PRODUCTS

2.1 DUCTS

A. Fabricate of zinc-coated lock forming quality steel sheets meeting requirements of ASTM A 527-85, "Specification for Sheet Steel Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality", with G 60 coating.

B. Use of aluminum, non-metallic, or round ducts is permitted only as directed on plans.

C. Kitchen hood exhaust ductwork shall be fabricated in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

1. Construct of 16 gage, carbon steel or 18 gage stainless steel, using continuous external welded joints.

2.2 DUCT JOINTS

A. Ducts with sides up to and including 36” shall be fabricated using SMACNA T-1 and T-3 joints.

B. Duct sizes over 36” shall be fabricated using SMACNA T-24 flange joints or pre-fabricated systems as follows -

1. Ducts with sides over 36” to 48”
   a. Transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA “E” or “G” Type connection).
   b. Approved Manufacturers
      1) Ductmate Industries Inc., 10760 Bay Meadows Drive, Sandy, UT 84092 (801) 571-5308
         Stockton, CA (800) 344-3270
         Pittsburgh, PA (800) 245-3188
      2) Nexus, Exanno Corp., P.O. Box 729, Buffalo, NY 14206 (714) 849-0545 3) WDCI, P.O. Box 10868, Pittsburgh, PA 15236 (800) 248-2355.

2. Ducts 48” & larger
   a. Ductmate/35, Nexus, or WDCI (Heavy) (SMACNA “J” Type connection).
   b. Approved Manufacturers
      1) Ductmate Industries Inc., 10760 Bay Meadows Drive, Sandy, UT 84092 (801) 571-5308
         Stockton, CA (800) 344-3270
         Pittsburgh, PA (800) 245-3188
      2) Nexus, Exanno Corp., P.O. Box 729, Buffalo, NY 14206 (714) 849-0545 3) WDCI, P.O. Box 10868, Pittsburgh, PA 15236 (800) 248-2355.

2.3 FLEXIBLE EQUIPMENT CONNECTIONS

A. 30 oz closely woven UL approved glass fabric, double coated with neoprene.

B. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 250°F.

C. Approved Manufacturers

1. Cain - N-100
2. Duro Dyne - MFN
3. Ventfabrics - Ventglas

2.4 DUCT SEALER

A. Approved Manufacturers

1. Cain - Duct Butter or Butter Tak
2. Design Polymerics - DP 1010
3. DSC - Stretch Coat
4. Duro Dyne - S2
5. Hardcast - #601 Iron-Grip or Peel-N-Seal Tape
6. Kingco - 15-325
7. Mon-Eco - 44-41
8. Trans-Continental Equipment Co - Multipurpose Duct Sealant
9. United - Sheet Metal duct-sealer

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ducts

1. Straight and smooth on inside with joints neatly finished unless otherwise directed.
2. Duct panels through 48” dimension having acoustic duct liner need not be crossbroken or beaded.
3. Crossbreak unlined ducts and duct panels larger than 48” or bead 12” on center.
4. Securely anchor ducts to building structure with specified duct hangers attached with screws or C-clamps.
5. Brace and install ducts so they shall be free of vibration under all conditions of operation.
6. Ducts shall not bear on top of structural members.
7. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on Drawings.
8. Ducts shall be large enough to accommodate inside acoustic duct liner. Dimensions shown on Drawings are net clear inside dimensions after duct liner has been installed.
9. Properly flash where ducts protrude above roof.
10. Install internal ends of slip joints in direction of flow. Make joints air tight using specified duct sealer.
11. Cover horizontal and longitudinal joints on exterior ducts with two layers of Hardcast tape installed with Hardcast HC-20 adhesive according to Manufacturer's recommendations.
12. Paint ductwork visible through registers, grilles, and diffusers flat black.

B. Install flexible inlet and outlet duct connections to each furnace, fan, fan coil unit, and air handling unit.

END OF SECTION 233114

SECTION 233115 - DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2. SUMMARY

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

B. Types of ductwork required for the project include the following:

1. Round
2. Rectangular
3. Oval
4. Spiral
5. Factory

C. Exterior Insulation of metal ductwork is specified in other Division-23 sections and is included as work of this section.

D. Refer to other Division-23 sections for exterior insulation of metal ductwork; not work of this section.

E. Refer to other Division-23 sections for ductwork accessories; not work of this section.

F. Refer to other Division-23 sections for fans and air handling units; not work of this section.

G. Refer to other Division-23 sections for mechanical controls; not work of this section.

H. Refer to other Division-23 sections for louvers; not work of this section.

I. Refer to other Division-23 sections for filters; not work of this section.

J. Refer to other Division-23 sections for air control boxes; not work of this section.

K. Refer to other Division-23 sections for grilles and diffusers; not work of this section.

L. Refer to other Division-23 sections for system commissioning, testing and balancing, work not of this section.

1.3. QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. The installer shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.

D. All workmen on the project shall carry state licenses as journeymen or apprentice sheet metal workers with additional certification for welders.

1.4. SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

B. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations and connections. Show interface and special relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.

D. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

1.5. REFERENCES

A. Codes and Standards

1. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems".
4. Uniform Building Code/Uniform Mechanical Code: Comply with all sections pertaining to mechanical work.

B. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTS

A. Standards: All duct fabrications shall comply with standards and techniques detailed by SMACNA “Duct Construction Manuals” for the appropriate pressure class, and with the ASHRAE Handbook, 1988 edition, Chapter 1, Duct Construction.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTMA A 525; mill phosphatized for exposed locations.

1. All materials and equipment specified under this section shall be American manufactured and made.

C. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide paint lock duct materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting. Installation of exposed ductwork shall be laid out in advance and submitted for review. Ductwork shall be hung straight and uniform, points shall be true, seams shall show continuity.

D. Kitchen hood exhaust ductwork shall be fabricated in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

1. Construct of 16-gauge, carbon steel or 18 gage stainless steel, using continuous external welded joints.

2.2 FITTINGS AND FABRICATION

A. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° lateral and 45° elbows for branch take-off connections. Where 90° branches are indicated, provide conical type tees.

B. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width, and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.

C. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Duct Accessories" for accessory requirements.

D. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive and fasten with mechanical fasteners.

E. Offset, transition, adapt ductwork to structural obstacles and work of other trades in a coordinated effort. Layout work to avoid conflict with piping, etc. With review of conditions, teardrop around conflicting piping, lights, etc., all at no added cost to the owner.

2.3 LOW PRESSURE ROUND DUCTWORK (1" SMACNA Pressure Class)

A. Round type ductwork for use on low velocity supply systems (1200 fpm maximum), low pressure (0.75" maximum duct pressure), shall be fabricated on 26-gauge galvanized steel sheets with snap-lock longitudinal seams and crimped and beaded joins.

B. All end joints shall have at least three screw fasteners and shall be wrapped airtight. Transverse and longitudinal seams shall be taped with "Hardcast TA". Elbows and fittings shall provide smooth air flow patterns and have a neat appearance.

C. Use factory fabricated elbows of the multi-sectional adjustable type.

2.4 LOW PRESSURE RECTANGULAR DUCTWORK (3" SMACNA Pressure Class)

A. Rectangular ductwork for use on supply systems up to 2" maximum duct static pressure and 2000 fpm maximum duct velocity shall be constructed of galvanized steel using construction for nominal 3" SMACNA rated systems. Seal all transverse joints with duct cement or tape with "Hardcast TA".

B. Use radius elbows or turning vanes with extended trailing edge. Use 45° tapping takeoffs with downstream balance damper.

C. Duct dimensions are inside clear. Increase for acoustical lining.

D. For rectangular exhaust ducts, increase metal gauge by 2 (i.e. 20 to 18) for all sizes. Seal all joints.

2.5 MEDIUM PRESSURE DUCTWORK (10" SMACNA Pressure Class)

A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct, and fittings.

B. Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gauges listed.

1.

Diameter	Minimum Gauge	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	16	Longitudinal Seam
60" to 84"	18	Spiral Lockseam

2. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.

C. Round Duct Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams. Mitered elbows shall be of at least 5 piece construction with R/D ratio of 1.5.

1.

Diameter	Minimum Gauge
3" to 36"	20
38" to 50"	18
Over 50"	16

D. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ASTM A 527, of spiral lockseam or longitudinal seam construction, in minimum gauges listed.

1.

Maximum Width	Minimum Gauge Spiral	Longitudinal
Under 25"	24	22
25" to 48"	22	20
49" to 70"	20	18

Stiffner Inserts	4'-0" on Center

E. Flat-Oval Duct Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams.

1.

Maximum Width	Minimum Gauge
Under 37"	20
37" to 50"	18
Over 50"	16

F. Internally Insulated Duct and Fittings: Construct with outer pressure shell, 1" thick, 3 pound insulation density layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gauges listed.

1. Equivalent to United McGill "Acoustic-K27".

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 12"	26-gauge	24-gauge
13" to 24"	24-gauge	24-gauge
25" to 34"	22-gauge	24-gauge
35" to 48"	20-gauge	24-gauge
49" to 58"	18-gauge	24-gauge
Over 59"	16-gauge	20-gauge

G. Duct work exposed on roof: Construct with outer pressure shell, 2" thick, 3-pound insulation density layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gauges listed.

H. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell.

1.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20-gauge	20-gauge
36" to 48"	18-gauge	20-gauge
Over 48"	16-gauge	20-gauge

I. Field joints shall be made up using an initial coat of 3M EC-750 adhesive wrapping the joint with a 3" wide fiberglass strip and applying a final seal coat of adhesive to the fiberglass. Duct sections and fittings shall be held in place at joints with sheet metal screws 6" on centers. Simple coating of joint surfaces with mastic prior to joining is not acceptable (SMACNA Std. P.1-11).

J. As an alternative method of duct joint sealing, the joints shall be held in place with screws as specified, but the contractor may use "Thermofit" duct sealing bands as manufactured by Rayclad Tubes of Menlo Park, California. Bands shall be installed according to the manufacturer's directions. The open flame shall not be used in the vicinity of combustible materials.

K. Oval ductwork shall be installed where called for on the plans and where required to conform to tight space requirements encountered during construction. The contractor shall furnish transition pieces as required. Oval ductwork shall have equivalent capacity to the round duct.

L. At the Contractor's option odd inch diameter round ducts may be increased in size to the next larger even inch providing space considerations are accommodated and all related conditions are resolved by the contractor.

M. Factory Duct: Factory duct shall be U.L. listed, Class 1 - Standard 181, of high-pressure construction neoprene impregnated fabric crimped on wire helix only, Wiremold 57 non-insulated. Flexmaster Type 4, insulated. Connect to duct with duct cement and steel or nylon drawbond. This specification applies to all high- and low-pressure factory duct on the project.

2.6 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Spin-in Fittings: Spin-in fittings shall be used to make round to rectangular duct connections. Use bell mouth fittings. Provide with locking quadrant dampers where balance is involved. Provide with insulation guard where insulated duct is involved.

C. Duct Sealing Compound: Duct sealing compound shall be 3M brand number EC-750 or Duro-Dyne S-2. This material shall be used in making up duct joints or in water proofing, caulking plenums, etc.

D. Acoustical Lining: Acoustical lining in ducts shall be 1' thick., 1½ pound density, coated, flexible glass fiber type, set in adhesive and impaled on weld studs spaced not more than 12" on centers and secured with lock washers. Airstream surface faced with black coated matte. Acoustical lining shall completely line the ducts. Lining shall have a fire and smoke hazard rating not exceeding 20-50-50. Owens-Corning, Johns-Manville, Certainteed.

1. All joints, edges and/or surface breaks in the coating of the acoustical lining shall be pointed up to a smooth surface with adhesive.

E. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives and Duct Thermal Insulation".

F. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.

G. Duct Cement: Non-hardening migrating mastic or liquid neoprene-based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.7 WATER HEATER BREECHING AND STACKS

A. Boiler breeching and stacks for gas-fired units shall be Metalbestos Type PS pressure stack suitable for forced draft fan operation. Furnish expansion joints as required. Outer pipe constructed of aluminized steel, and inner pipe of 316 stainless steel with locking band and exterior channel band. Pressure stack system shall be U.L. rated.

2.8 FLEXIBLE EQUIPMENT CONNECTIONS

A. 30 oz closely woven UL approved glass fabric double coated with neoprene.

B. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 250º F.

C. Approved Manufacturers

1. Cain - N-100
2. Duro Dyne - MFN
3. Ventfabrics - Ventglas

2.9 CONCEALED CEILING DAMPER REGULATORS

A. Approved Manufacturers

1. Cain
2. Duro Dyne
3. Metco Inc
4. Vent-Lock - #666
5. Young - #303

2.10 VOLUME DAMPERS

A. In Main Ducts

1. 16-gauge galvanized steel opposed blade type with 3/8” pins and end bearings. Blades shall have 1/8” clearance all around.
2. Damper shall operate within acoustical duct liner.
3. Provide channel spacer equal to thickness of duct liner.
4. Approved Manufacturers
    a. Air Balance
    b. Air Control Products
    c. American Warming
    d. Greenheck
    e. Vent Products

B. In Sheet Metal Branch Ducts

1. Extruded aluminum opposed blade type. When in open position, shall not extend beyond damper frame.
2. Maximum blade length 12".
3. Damper Regulator shall be concealed type with operation from bottom or with 90º miter gear assembly from side.
4. Approved Manufacturers
   a. Air Control Products
   b. Air Guide
   c. Arrow
   d. Reliable Metals
   e. Tuttle & Bailey
   f. Young

C. Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, provide concealed ceiling damper regulator and cover plate.

2.11 MOTORIZED OUTSIDE AIR DAMPERS

A. Damper Blades

1. 18-gauge galvanized steel or equivalent aluminum with replaceable rubber blade edges, 9" wide maximum.
2. End seals shall be flexible metal compression type.
3. Opposed blade type.

B. Make provision for damper actuators and actuator linkages to be mounted external of air flow.

C. Approved Manufacturers & Models -

1. American Warming - VC-2-AAVA
2. Arrow - OBDAF-207
3. Greenheck - VCD-2100
4. Honeywell - D641
5. Johnson - D1300
6. Louvers & Dampers - TSD400
7. Ruskin - CD36 or CD60
8. Vent Products - 5800

PART 3 - EXECUTION

3.1 INSPECTION

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF METAL DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve airtight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold duct true-to-shape and to prevent buckling. Support vertical ducts at every floor.

B. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary, the required area shall be maintained. All of these changes must be approved and installed as directed at project. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering.

C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details, and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to ½" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished or occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

E. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures.

F. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1½". Fasten to duct and substrate.

1. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate, in accordance with requirements of Division-27 Section "Firestopping".

G. Ducts at Masonry: Where ducts are shown connecting to or passing through gypsum board, masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2-1/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal in these locations shall be bolted to the angle iron. Round high velocity ducts in vertical chases shall be supported with rolled angle rings.

H. Cross Breaking: Rectangular sheet metal ducts shall be cross broken on the four sides of each 4’ panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4’ panels of straight sections of ducts shall be cross broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles; the center of cross break shall be of the required height to assure surfaces being rigid.

I. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls, and other associated work of ductwork system.

J. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

K. Install concealed ceiling damper regulators.

1. Paint cover plates to match ceiling tile.
2. Damper regulators will not be required for dampers located directly above removable ceilings or in Mechanical Rooms.

L. Provide each take-off with an adjustable volume damper to balance that branch.

1. Anchor dampers securely to duct.
2. Install dampers in main ducts within insulation.
3. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
4. Where concealed ceiling damper regulators are installed, provide a cover plate.

3.3 INSTALLATION OF DUCT LINER

A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.

B. All supply, return, and outside air ductwork shall be lined with acoustical insulation.

3.4 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 3'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible".

3.5 HANGERS AND SUPPORTS

A. It is essential that all ducts shall be rigidly supported. Hangers for low velocity ducts up to 18" in width shall be placed on not more than 10' centers.

B. Low velocity ducts 19" through 35" in width and greater shall be supported on not more than 5' centers. Where vertical ducts pass through floors or roofs, heavy supporting angles shall be attached to ducts, and to structure. Angles shall be of sufficient size to support the ductwork rigidly and shall be placed on at least two sides of the duct.

C. Construct hangers for rectangular ductwork from galvanized iron 1" x 1/16". Hangers shall extend down the sides of rectangular ducts the full dept of the duct and shall be bent underneath the duct 2". Hangers shall be secured to the duct using sheet metal screws or rivets of appropriate sizes on 6" centers, but not less than two screws in the side and one in the bottom of each hanger.

D. For rectangular ducts 36" and greater in width construct hangers from galvanized iron 1½" x 1/16". Hangers shall be installed and secured to duct as described in Paragraph B.

3.6 SUPPORTING DAMPERS

A. Parallel and opposed blade motor operated dampers shall be supported by reinforcing the ductwork or sheet metal walls at the damper locations to carry the weight of the dampers and the force exerted on the dampers due to air pressure, or shall be supported independent of ductwork from the ceiling of floor, as conditions at the site determine.

3.7 CONNECTIONS

A. Connections of high velocity supply and exhaust ducts, fittings, and high velocity mixing boxes shall be made airtight by coating joints with Minnesota Mining Co. Mastic, Type EC-800, Benjamin Foster, Sheet Metal Products Co., or approved equal, before joining, and then sealing the joint with one layer of "Glass-Fab" reinforcing tape set in a coating of the above compound. Tape and sealant shall not exceed a flame spread of 25 or a smoke development of 50.

3.8 WELDED JOINTS

A. Welded ductwork shall have either an angle or a piece of 1/8" steel bar behind each weld to allow laying of a neat and continuous bead.

3.9 AESTHETIC LAYOUTS

A. Contractor shall locate all diffusers, grilles, and other exposed items in such a manner as to fit symmetrically in any grid system or other aesthetic architectural or lighting pattern. Refer to reflected ceiling plans and electrical lighting layouts for additional information. Provide duct offsets or extensions as required to make a proper installation.

3.10 FIELD QUALITY CONTROL

A. Leakage Tests: After each duct system which is constructed for duct classes over 3" is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Air leaks which are in excess of that required to bubble the soap suds (that is, actually blow the suds away) shall be sealed by additional taping and caulking to reduce the leakage to a rate not to exceed slow bubbles forming. Repair leaks and repeat tests until total leakage is less than 1% of system design air flow.

3.11 EQUIPMENT CONNECTION

A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.12 ADJUSTING AND CLEANING

A. Clean ductwork internally of dust and debris, as follows: Before the ceilings are installed, with filters in place, operate the fans at full capacity to blow out dirt and debris from ducts. If it is not practical to use the main supply blower for this test, the ducts may be blown out in sections by a portable fan.

B. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal, or where ductwork is to be painted, might interfere with painting or cause paint deterioration.

C. Balancing:

1. Refer to Division-23 section "Testing, Adjusting and Balancing" for air distribution balancing of metal ductwork; not work of this section. However, the Sheet Metal Contractor shall participate fully in this work. Seal any leaks in ductwork that become apparent in balancing process.
2. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor and his subcontractors shall make any changes necessary to obtain the specified conditions.

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to:

1. Furnish and install duct accessories in specified ductwork as described in Contract Documents.

B. Related Sections:

1. Section 230933: Temperature control damper actuators and actuator linkages.
2. Section 233001: Common Duct Requirements.

1.2 REFERENCES

A. American Society for Testing and Materials:

1. ASTM A 653-02a, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.'
2. ASTM C 665-01, 'Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.'
3. ASTM C 1071-00, 'Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Acoustical Material).'

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Acoustical Liner System:

1. Duct Liner:
   a. 1” thick, 1.5 pcf (24kg/m³ density fiberglass conforming to requirements of ASTM C 1071. Liner will not support microbial growth when tested in accordance with ASTM C 665. Additional duct wrap may be required to meet insulation requirements. See Section 23 0713.
   b. Category Four Approved Products. See Section 01 6000 for definitions of Categories.
      1) Ultralite or ToughGard by CertainTeed.
      2) Duct Liner E-M by Knauf Fiber Glass.
      3) Akousti-Liner by Manson Insulation.
      4) Aeroflex Plus by Owens Corning.
      5) Linacoustic by Johns-Manville.

2. Adhesive:
   a. Category Four Approved Water-Based Products. See Section 016000 for definitions of Categories.
      1) Cain: Hydrotak.
      2) Design Polymerics: DP2501 or DP2502 (CMCL-2501).
      3) Duro Dyne: WSA.
      4) Hardcast: IA-901.

5) Kingco: 10-568.
6) Miracle: PF-101.
7) Mon-Eco: 22-67 or 22-76.
8) Polymer Adhesive: Glasstack #35.
9) Techno Adhesive: 133.
10) United McGill: Uni-tack.

b. Category Four Approved Solvent-Based (non-flammable) Products. See Section 016000 for definitions of Categories.
1) Cain: Safetak.
2) Duro Dyne: FPG.
3) Hardcast: Glas-Grip 648-NFSE.
4) Kingco: 15-137.
5) Miracle: PF91.
6) Mon-Eco: 22-24.
7) Polymer Adhesive: Q-Tack.
8) Techno Adhesive: 'Non-Flam' 106.

c. Category Four Approved Solvent-Based (flammable) Products. See Section 016000 for definitions of Categories.
1) Cain: HV200.
2) Duro Dyne: MPG.
3) Hardcast: Glas-Grip 636-SE.
4) Kingco: 15-146.
5) Miracle: PF-96.
6) Mon-Eco: 22-22.
7) Polymer Adhesive: R-Tack.
8) Techno Adhesive: 'Flammable' 106.

3. Fasteners:
a. Adhesively secured fasteners not allowed.
b. Category Four Approved Products. See Section 016000 for definitions of Categories.
1) AGM Industries Inc: 'DynaPoint' Series RP-9 pin.
2) Cain.
3) Duro Dyne.
4) Dyn Air: DWT or FWT
5) Omark dished head 'Insul-Pins.'
6) Gripnails may be used if each nail is installed by 'Grip Nail Air Hammer' or by 'Automatic Fastener Equipment' in accordance with Manufacturer's recommendations.

B. Flexible Equipment Connections:

1. 30 oz closely woven UL approved glass fabric double coated with neoprene.
2. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant temperatures of 250º F 121º C.
3. Category Four Approved Products. See Section 016000 for definitions of Categories.
a. Cain: N-100.
b. Duro Dyne: MFN.
c. Dyn Air: CPN with G-90 galvanized off-set seam
d. Elgen: ZLN.
e. Ventfabrics: Ventglas.
f. Ductmate: ProFlex.

C. Duct Access Doors:

1. Factory built insulated access door with hinges and sash locks. Construction shall be galvanized sheet metal, 24 ga.
2. Fire and smoke damper access doors shall have minimum clear opening of 12 in² or larger as shown on Drawings.
3. Category Four Approved Products. See Section 016000 for definitions of Categories.
   a. Air Balance: Fire/Seal FSA 100.
   b. Air-Rite: Model HAD-2.
   c. Cesco: HDD.
   d. Flexmaster: Spin Door.
   e. Kees Inc: ADH-D.
   f. Nailor: 085H-01.
   g. Pottorff: 60-HAD.
   h. Ruskin: ADH-24.

D. Dampers and Damper Accessories:

1. Locking Quadrant Damper Regulators:
   a. Category Four Approved Products. See Section 016000 for definitions of Categories.
      1) Duro Dyne: KS-38.
      2) Dyn Air: QPS-385
      3) Ventfabrics: Ventline 555.
      4) Young: No. 1.

2. Concealed Ceiling Damper Regulators:
   a. Category Four Approved Products. See Section 016000 for definitions of Categories.
      1) Cain.
      2) Duro Dyne.
      3) Metco Inc.
      4) Ventfabrics: 666 Ventlok.
      5) Young: 301.

3. Volume Dampers:
   a. Factory-manufactured 16 ga galvanized steel, single blade and opposed blade type with 3/8" axles and end bearings. Blade width 8" maximum. Blades shall have 1/8" clearance all around.
      1) Damper shall operate within acoustical duct liner.
      2) Provide channel spacer equal to thickness of duct liner.
   b. Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
   c. Category Four Approved Products. See Section 016000 for definitions of Categories.
      1) Air-Rite: Model CD-2.
      2) American Warming: VC-2-AA.
      3) Arrow: OBDAF-207.
      4) C & S: AC40.
      5) Cesco: AGO.
      6) Daniel: CD-OB.
      7) Greenheck: VCD-20.
      8) Pottorff: CD-42.
      9) Ruskin: MD-35.

10) UTEMP: CD-OB.

4. Motorized Outside Air Dampers:
   a. Low leakage type. AMCA certified.
   b. Damper Blades:
      1) Steel or aluminum airfoil type with mechanically locked blade seals, 8" blade width maximum measured perpendicular to axis of damper.
      2) Jamb seals shall be flexible metal compression type.
      3) Opposed or single blade type.
   c. Make provision for damper actuators and actuator linkages to be mounted external of air flow.
   d. Category Four Approved Products. See Section 01 6000 for definitions of Categories.
      1) Air Balance: AC 526.
      2) American Warming: AC526.
      3) Arrow: AFD-20.
      4) C & S: AC50.
      5) Cesco: AGO3.
      6) Honeywell: D-643.
      7) Pottorff: CD-52.
      8) Ruskin: CD-60.

5. Backdraft Dampers:
   a. Backdraft blades shall be nonmetallic neoprene coated fiberglass type.
   b. Stop shall be galvanized steel screen or expanded metal, ½" mesh.
   c. Frame shall be galvanized steel or extruded aluminum alloy.
   d. Category Four Approved Products. See Section 01 6000 for definitions of Categories.
      1) Air-Rite: Model BDD-3.
      2) American Warming: BD-15.
      3) C & S: BD30.
      4) Cesco: FBD 101.
      5) Daniel: FBD-H/V.
      6) Pottorff: 50FBD.
      7) Ruskin: NMS2.
      8) UTEMP: BFEA.

E. Duct Silencers:

1. Category Four Approved Products. See Section 01 6000 for definitions of Categories.
   a. Air Filter Corp: AIRSAN.
   b. Industrial Acoustic Co.
   c. Titus Products Div.
   d. United McGill Corp.

F. Air Turns:

1. Single thickness vanes. Double thickness vanes not acceptable.
2. 4-1/2" wide vane rail. Junior vane rail not acceptable.

G. Branch Tap for Flexible Ductwork:

1. Factory-manufactured rectangular-to-round 45º leading tap fabricated of 24 ga zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A 653, with G-90 coating.

2. 1” wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.
3. Manual Volume Damper:
   a. Single blade, 22 ga
   b. 3/8” minimum square rod with brass damper bearings at each end.
   c. Heavy-duty locking quadrant on 1½” high stand-off mounting bracket attached to side of round duct.

4. Category Four Approved Products. See Section 01 6000 for definitions of Categories.
   a. ST-1HD by Air-Rite.
   b. STO by Flexmaster.
   c. HET by Sheet Metal Connectors.

2.2 MANUFACTURERS

A. Contact Information:

1. AGM Industries, Brockton, MA www.agmind.com.
2. Air Balance Inc, Holland, OH www.air-balance.com.
3. Air Filters Inc, Baltimore, MD www.afinc.com.
4. Air-Rite Manufacturing, Bountiful, UT www.air-ritemfg.com.
5. American Warming & Ventilating, Holland, OH www.american-warming.com.
6. Arrow United Industries, Wyalusing, PA www.arrowunited.com.
7. Cain Manufacturing Company Inc, Pelham, AL www.cainmfg.com.
8. C&S Air Products, Montebello, CA www.csairproducts.com.
9. CertainTeed Corp, Valley Forge, PA www.certainteed.com.
10. Cesco Products, Minneapolis, MN www.cescoproducts.com.
11. Daniel Manufacturing, Ogden, UT (801) 622-5924.
12. Design Polymerics, Fountain Valley, CA www.designpoly.com.
13. Ductmate Industries Inc, East Monongahela, PA www.ductmate.com.
14. Duro Dyne, Farmingdale, NY www.durodyne.com.
15. Dwyer Instruments Inc, Michigan City, IN www.dwyer-inst.com.
16. Flexmaster USA Inc, Houston, TX www.flexmasterusa.com.
17. Greenheck Corp, Schofield, WI www.greenheck.com.
18. Gripnail Corp, East Providence, RI www.gripnail.com.
19. Hardcast Inc, Wylie, TX www.hardcast.com.
20. Honeywell Inc, Minneapolis, MN www.honeywell.com.
21. Industrial Acoustics Co, Bronx, NY www.industrialacoustics.com.
22. Johns-Manville, Denver, CO www.jm.com.
23. Kees Inc, Elkhart Lake, WI www.kees.com.
24. Kingco - King Adhesive Corp, St Louis, MO (800) 233-8171 or (314) 772-9953.
25. Knauf Fiber Glass, Shelbyville, IN www.knauffiberglass.com.
26. Manson Insulation Inc, Brossard, QB www.isolationmanson.com.
27. Metco Inc, Salt Lake City, UT (801) 467-1572.
28. Miracle.
29. Mon-Eco Industries Inc, East Brunswick, NJ (800) 899-6326 or (908) 257-7942.
30. Nailor Industries Inc, Houston, www.nailor.com.
31. Omark.
32. Owens Corning, Toledo, OH www.owenscorning.com.
33. Polymer Adhesive Sealant Systems Inc, Irving, TX www.polymeradhesives.com.
34. Pottorff Company, Montebello, CA www.pottorff.com.
35. Ruskin Manufacturing, Kansas City, MO www.ruskin.com.
36. Sheet Metal Connectors Inc, Minneapolis, MN www.smconnectors.com.
37. Techno Adhesive.
38. Titus, Richardson, TX (972) 699-1030. www.titus-hvac.com

39. United McGill Corp, Columbus, OH www.unitedmcgill.com.
40. Utemp Inc, Salt Lake City, UT (801) 978-9265.
41. Ventfabrics Inc, Chicago, IL www.ventfabrics.com.
42. Young Regulator Co, Cleveland, OH www.youngregulator.com.

2.3 FABRICATION

A. Duct Liner:

1. Install mat finish surface on airstream side. Secure insulation to cleaned sheet metal duct with continuous 100% coat of adhesive and with ¾" long mechanical fasteners 1' on center maximum unless detailed otherwise on Drawings. Pin all duct liner.
2. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation shall overlap sides. If liner is all one piece, folded corners shall be tight against metal. Ends shall butt tightly together.
3. Coat longitudinal and transverse edges of liner with adhesive.

B. Air Turns:

1. Permanently install vanes arranged to permit air to make abrupt turn without appreciable turbulence, in 90º elbows of above ground supply and return ductwork.
2. Quiet and free from vibration when system is in operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Duct Liner:

1. Furnish and install acoustic lining in following types of ducts:
   a. Supply air.
   b. Return air.
   c. Mixed air.
   d. Transfer air.
   e. Relief air.
   f. Exhaust air.
   g. Elbows, fittings, and diffuser drops greater than 12" in length.
   h. Concrete underfloor boxes.

B. Flexible Connections: Install flexible inlet and outlet duct connections to each furnace.

C. Access Doors in Ducts:

1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6" of installed dampers.
2. Install within 6" of fire dampers and in Mechanical Room if possible. Install on side of duct that allows easiest access to damper.

D. Dampers and Damper Accessories:

1. Install concealed ceiling damper regulators.
   a. Paint cover plates to match ceiling tile.

b. Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.

2. Provide each take-off with an adjustable volume damper to balance that branch.
   a. Anchor dampers securely to duct.
   b. Install dampers in main ducts within insulation.
   c. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
   d. Where concealed ceiling damper regulators are installed, provide cover plate.

3. Install motorized dampers.

END OF SECTION 233300

SECTION 233316 - FIRE AND FIRE/SMOKE DAMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install fire or fire/smoke dampers at penetrations of fire rated walls, floors, & ceilings, at ducts, registers, grilles, or louvers as described in Contract Documents.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Dampers shall conform to UL and NFPA requirements and bear UL label.
2. Dampers shall be approved by State Fire Authorities where so required.
3. Fire damper installation shall conform to details shown in SMACNA Fire Damper Guide and as required by local codes.

1.4 MAINTENANCE

A. Extra Materials

1. Leave six fusible links of each rating type used on Project with Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Fire Dampers

1. At Walls & Floors - Type "B" with 212º F link unless otherwise indicated on Drawings.
2. Ceilings
   a. Radiation type ceiling fire damper with 212º F link unless otherwise indicated on Drawings.
   b. Damper serviceable from access door located on either side of damper.
   c. Approved Manufacturers
      1) Air Balance Inc
      2) Cesco
      3) Pottorff
      4) Safe Air Inc
      5) Ultra-Safe

B. Combination Smoke & Fire Dampers

1. At the wall and ceiling.
   a. Folding blade type.
   b. Motorized damper to operate at 115V and draw 0.2 amps maximum.
   c. Damper shall close on
      1) Signal from smoke detectors
      2) Power failure
      3) Failure of fusible link.
   d. Minimum of 10 ga galvanized steel sleeve with 18 ga closure and damper blades. Blades shall fold into compact package completely out of air stream.
   e. Furnish 212°F UL listed fusible link.
   f. Damper serviceable from access door located on either side of damper.
   g. Approved Manufacturers
      1) Ruskin
      2) Equal by Prefco or Pottorff

2.2 ACCESS DOORS IN CEILINGS

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

B. This Section includes access doors for installation in the following types of construction:

1. Gypsum drywall.

C. Provide fire-rated access doors.

D. SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   a. Product data in form of manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions, and directions for installation of anchorage, devices.
      1) Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions, and other data pertinent to installation.

E. Single-Source Responsibility: Obtain access doors for entire project from one source from a single manufacturer.

F. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters Laboratories, Inc.'s "Building Materials Directory" for rating shown.

1. Provide UL label on each fire-rated access door.

G. Size Variations: Obtain Engineer's acceptance of manufacturer's standard size units, which may vary slightly from sized indicated. Figure 24 x 24 during bid, if not size is given.

H. Coordination: Furnish inserts and anchoring devices that must be built into other work for installation of access doors. Coordinate delivery with other work to avoid delay.

I. Verification: Examine the plans for all fire and fire/smoke dampers and concealed equipment. Provide the sizes for required access doors and concealed equipment.The contractor is responsible for providing fire rated or non-rated as need requires.

J. Manufacturers: Subject to compliance with requirements, provide access doors by one of the following:

1. J.L. Industries
2. Karp Associates, Inc.
3. Milcor, Inc.
4. Nystrom, Inc.
5. The Williams Brothers Corp.

K. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts, and ready for installation.

L. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

M. Frames: Fabricate from 16-gage steel.

1. Fabricate frame with exposed flange nominal 1” wide around perimeter of frame for units installed in the following construction
   a. Drywall finish.

2. For gypsum drywall, furnish perforated frames with drywall bead.

N. Flush Panel Doors: Fabricate from not less than 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175º. Finish with manufacturer's factory-applied prime paint.

1. For fire-rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

O. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.

1. Provide one cylinder lock per access door. Furnish 2 keys per lock. Key all locks alike, unless otherwise scheduled.

P. Comply with manufacturer's instructions for installation of access doors.

Q. Coordinate installation with work of other trades.

R. Adjust hardware and panels after installation for proper operation.

S. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 233316

SECTION 233346 - NON-METAL FLEXIBLE DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section 233114 - Volume dampers and sheet metal ducts

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install supply air branch duct runouts to diffusers as described in Contract Documents.

PART 2 - PRODUCTS

2.1 DUCTS

A. Formable, flexible, circular duct which shall retain its cross-section, shape, rigidity, and shall not restrict air flow after bending.

B. Nominal 1½" thick, ¾ lb/cu ft density fiberglass insulation with air-tight, polyethylene or polyester core, sheathed in seamless foil vapor barrier jacket factory installed over flexible assembly.

C. Assembly, including insulation and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.

D. Approved Manufacturers

1. ANCO-FLEX
2. Flex-Aire - PF/UPC
3. Flexible Air Movers Inc
4. Thermaflex
5. Codywest - Type NIL-M
6. Flex Master - Type 8M

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct in fully extended condition free of sags and kinks, using 4' maximum lengths. Ductwork shall not be used for 45º to 90º elbows.

B. Make duct connections by coating exterior of duct collar for 3” with duct sealer and securing duct in place over sheet metal collar with ½” wide metal cinch bands and sheet metal screws.

END OF SECTION 233346

SECTION 233400 - EXHAUST FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install exhaust fans as described in Contract Documents.

1.3 QUALITY ASSURANCES

A. Requirements of Regulatory Agencies -

1. Bear AMCA seal and UL label.

PART 2 - PRODUCTS

2.1 CEILING MOUNTED EXHAUST FANS

A. Acoustically insulated housings.

B. Include shatterproof integral back-draft damper with no metal to metal contact.

C. True centrifugal wheels.

D. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.

E. Suitably ground motors and mount on rubber-in shear vibration isolators.

F. Provide wall or roof cap, as required.

G. Approved Manufacturers

1. Cook-Gemini
2. Greenheck Sp
3. PennBarry Zephyr

2.2 ROOF MOUNTED EXHAUST FANS

A. Direct drive or have adjustable pitch V-belt as noted on Drawings.

B. Wheels shall be backward curved and housing shall be removable or hinged aluminum.

C. Isolate motor with vibration dampeners.

D. Provide motorized type back-draft dampers and interlocked with fan motors. Damper shall have 5% leakage.

E. Insulated, pre-fabricated metal roof curb shall be for flat or sloped roof as shown on Drawings.

F. Approved Manufacturers

1. Fans
   a. Acme
   b. PennBarry
   c. Cook
   d. Greenheck
   e. Jenn-Air

2. Standard curbs
   a. Acme
   b. Penn Barry
   c. Cook
   d. Greenheck
   e. Jenn-Air

3. Sound attenuating curbs
   a. Acme
   b. PennBarry
   c. Cook
   d. Greenheck
   e. Jenn-Air

2.3 ROOF MOUNTED KITCHEN EXHAUST FANS

A. Adjustable pitch V-belt as noted on Drawings.

B. Wheels shall be backward curved, and housing shall be removable and hinged aluminum for easy cleaning.

C. Fans shall be labeled "U.L. Listed for grease removal".

D. Isolate motor with vibration dampeners.

E. Provide drain and grease trap.

F. Provide vented, prefabricated metal corrugated roof curb for flat or sloped roof as shown on Drawings.

G. Curb mounted weatherproof disconnect switch.

H. Approved Manufacturers -

1. Fans and curbs
   a. PennBarry
   b. Cook
   c. Greenheck
   d. Jenn-Air

2.4 INLINE FAN

A. Duct mounted supply, exhaust or return fans shall be of the centrifugal, direct driven or belt driven in-line type.

B. The fan housing shall be of the square design, constructed of heavy gauge galvanized steel and shall include square duct mounting collars.

C. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components.

D. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

E. Motors shall be permanently lubricated and carefully matched to the fan loads. Motors shall be readily accessible for maintenance.

F. A NEMA I disconnect switch shall be provided as standard Factory wiring shall be provided from motor to the handy box.

G. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

H. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

I. Motors in the airstream shall have fan wheel mounted to motor shaft and support for weight. Motors and drives that are mounted out of the airstream shall provide the following:

1. Drives shall be sized for a minimum of 150% of driven horsepower.
2. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
3. Motor pulleys shall be adjustable for final system balancing.

J. Approved Manufacturers

1. PennBarry
2. Cook
3. Greenheck
4. Jenn-Air

2.5 ROOF MOUNTED SMOKE AND HEAT EXHAUST

A. All components in the airstream shall be constructed of steel to ensure dependable operation at high temperatures.

B. Windbands shall be heavy gauge steel with reinforced edges for additional strength.

C. Fan housings shall be constructed of welded heavy gauge steel, rigidly supported to prevent vibration and pulsation.

D. Provide steel butterfly style dampers with rolled edges for strength and weather protection. Provide damper stops to maintain proper damper position, and gasket line the edge of the fan discharge for quiet damper closure.

E. Provide fusible link damper to automatically open the butterfly dampers when the air temperature below the damper blades exceeds 165° F to provide smoke and heat relief with no electrical power required.

F. All structural steel components shall be coated with Penn-Tector™ thermally fused polyester.

G. Fan shaft shall be turned, precision ground and polished steel sized so that the first critical speed is at least 25% over the maximum operating speed.

H. Install a heat slinger mounted to the fan shaft between the propeller and the bearing cover to dissipate heat from the fan shaft and to draw cooling air over the bearings, shaft and drive.

I. Standard heavy duty bearings shall be self-aligning ball type in pillow block mounts. Bearings rating shall be in excess of 200,000 hours.

J. Provide extended lubrication lines with grease fittings to permit east of bearing lubrication.

K. Drives shall be multiple groove, machined cast iron, sized for a minimum of 150% of driven horsepower. Motor pulleys are adjustable for balancing.

L. Protect bearings and drives from the airstream by welded, heavy gauge steel belt tubes and bolted bearing covers.

M. Mount heavy duty ball bearing motors out of the airstream.

N. Weatherproof motor covers shall be vented for proper motor cooling.

O. Provide vented, pre-fabricated metal corrugated roof curb for flat or sloped roof as shown on drawings.

P. Curb mounted weather proof disconnect switch.

Q. Approved manufacturers

1. Fans and curbs
    a. PennBarry
    b. Cook
    c. Greenheck
    d. Jenn-Air

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor fan units securely to structure or curb.

END OF SECTION 233400

SECTION 233427 - RANGE HOOD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 -Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section 233400 – Exhaust Fans.

D. Section 233114 – Low Pressure Steel Ductwork.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install range hood as described in contract documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The range hood shall be constructed of 22 gage steel, with mitered sides and welded construction. Mounting holes shall be taped to mount below a cabinet.

B. Hood shall be coated with white, baked-on enamel.

C. A permanent aluminum mesh grease filter shall be located in the exhaust inlet. The filter shall be anchored in place with metal cups or wing nuts.

D. A hood light shall be enclosed in a glass cover with grease seals and be dual level switching.

E. The hood shall be 42" long and designed to exhaust 200 cfm vertically.

F. Provide remote roof or wall exhaust fan manufactured by hood manufacturer.

G. Approved Manufacturers:

1. Nutone MM6500.
2. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hood above range and anchor securely to horizontal or vertical wall structure.

B. Provide low pressure exhaust duct from hood to roof exhaust outlet. Duct shall be sealed, per section 233115.

C. Power and wire hood light according to section 260000.

D. Hood fan shall be controlled by hood switch.

END OF SECTION 233427

SECTION 233428 - AUTOMATIC EXHAUST HOSE REEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. The Automatic Exhaust Hose Reel Series 860 shall be the type supplied by Nederman, Inc.

B. The vehicle exhaust system shall be comprised of an automatic exhaust hose reel with the following features:

1. The drum and frame shall be constructed of heavy steel, coated with a 15 micron thickness of aluminum zinc alloy to resist corrosion. The flanged ends of the drum shall be painted and baked for longevity. The re-wind system shall consist of a removable spring cassette housing two special spring steel springs with an automatic ratcheted latch and lock mechanism. A hose guide shall be mounted to the reel drum to allow one man operation when re-winding the hose supplied on the reel.
2. The hose shall be of EPDM rubber enclosing a galvanized steel helix and polyester fabric with an uninterrupted smooth bore for efficient air flow. The hose shall be able to withstand temperatures of 255°F continuously and 350°F intermittently and shall be available in 4" or 5" diameter. The exterior shall be black, corrugated and granular for gripping to the reel drum to protect against scuff and abrasion. The connection hose between the exhaust hose and the 6" aluminum cast swivel discharge of the reel shall be 6.25" flex aluminum to diminish the resistance through the reel drum and shall be factory sealed and greased. The hose on the reel shall have an adjustable hose stop to allow for easy adjustment of the length of the hose hanging off the reel when the hose is re-coiled. The reel shall have a zinc plated tubular bar mounted on the frame structure for the adjustable hose stop to rest against. The reel shall allow for the addition of an automatic micro switch for fan control and shall permit direct mounting of a fan with use of a mounting flange. The hose stop shall have the same performance as the hose.
3. The re-coil and uncoiling functions of the exhaust hose reel shall be enacted by the direct pulling of the hose that is supplied on the reel. The exhaust hose reel shall come completely assembled and ready for installation. The hose reel shall have four zinc coated mounting feet, having ½” bolt holes for easy mounting to ceiling joists, threaded rods or wall mounts.
4. The spring cassette mechanism warranty shall be for a period of three years from date of shipment from Nederman, Inc. with a one year warranty on all other parts.
5. Weight: approx. 75 lbs. without hose.

C. The 803 series vehicle exhaust extraction nozzle shall be the type supplied by Nederman, Inc. It shall be constructed of heavy duty EPDM rubber which shall reduce surface heat buildup on the nozzle and protect the vehicle from scraped or paint damage.

1. The nozzle shall be secured to the vehicle by a fully adjustable, quick release locking "C" clamp which will ensure positive attachment to even the shortest piece of exposed vehicle exhaust pipe. A built in guard screen shall prevent debris from being drawn into the exhaust system, causing potential clogging of exhaust duct. It shall be equipped with a constant torque spring loaded shutoff flap which will automatically seal off intake into the nozzle when not in use. The nozzle shall have a 13-18" flexible metal heat shield hose attached (dependent on hose diameter) which slides inside the exhaust extraction hose, thereby acting as a heat shield to the exhaust hose. The exhaust nozzle shall be equipped with two ports: one will enable the sampling of exhaust gases while attached to the exhaust pipe and the other port will allow the return of the sample gas into the exhaust system. The nozzle mouth shall have an isosceles triangular opening which will accommodate single exhaust pipes and most twin side by side exhaust pipes.
2. The nozzle shall resist temperatures of up to 175°F continuously and up to 325°F intermittently.
    a. Nozzle model #803561 shall accommodate 4" diameter hose, at a weight of 7.7 lbs.

3. The Triangular Exhaust Nozzle, Series 803, warranty shall be for a period of one year from date of shipment from Nederman, Inc.

END OF SECTION 233428

SECTION 233429 - VEHICLE EXHAUST

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

1.1 SUMMARY

A. Includes but not limited to

1. Furnish and install fire engine overhead exhaust system as described in contract documents.

PART 2 - PRODUCTS

2.1 GENERAL

A. Factory assemble unit, UL listed with rail hoses, balancer and trolley, striker plate, end studs electromagnet assembly, nozzle and complete wiring.

B. Horizontal Guide Rail:

1. Horizontal Guide Rail shall be made of low carbon strip steel and shall have a minimum 12 gauge wall thickness. The rails shall have a non-toxic, alkyd enamel, rust preventative finish. Each Horizontal Guide Rail shall be provided with adjustable, self-aligning clamping brackets to accommodate the mounting of the Guide Rail to the support structure. Mounting brackets must fully wrap the external surface of the rail to assure a solid, safe connection. The Clamping Bracket mounting points shall not exceed 9'-6" on center.

C. Horizontal Suction Hose

1. The Horizontal Suction Hose shall be 6" in diameter and has been successfully tested to expand and contract a minimum of 100,000 runs without premature wear. The material of the hose shall be of a Trevira fabric covered with HYPALON. The hose shall be fire resistant according to DIN 4102 B1 ratings. The hose shall be capable of withstanding temperatures of 340° F continuously and up to 370° F intermittently. Hose shall have a compression ratio of 6:1. The helix shall be external and made of galvanized steel or aluminum. The helix shall support eyelets connected to nylon cylinders that connect the Horizontal Suction Hose to the Guide Rail itself. The eyelet's and nylon cylinders shall allow the Horizontal Suction Hose to easily move so that it can facilitate the vehicles inward and outward movements. In addition, the eyelet's and nylon cylinders will keep the Horizontal Suction Hose from drooping or hanging down which could hinder movement of people or vehicles within the vehicle bay.

D. Upper Vertical Suction Hose

1. The Horizontal Suction Hose shall be 6" in diameter and has been tested to expand and contract a minimum of 100,000 runs without premature wear. The material of the hose shall be of a Trevira fabric covered with HYPALON. The hose shall be fire resistant according to DIN 4102 B1 ratings. The hose shall be capable of withstanding temperatures of 340° F continuously and up to 370° F intermittently. Hose shall have a compression ratio of 6:1. The helix shall be external and made of galvanized steel or aluminum.

E. Balancer & Trolley Assembly

1. Balancer must be the type that has an adjustable centrifugal brake to assure that the cord and hose rewind slowly onto the Balancer, preventing a potentially dangerous "whipping" action of the hose during retrieval. For added safety, the balancer shall have a reversed spring characteristic, which provides gradual reduction of the spring power the further the retrieval cord is extended. Lifting power of the balancer shall be the greatest when needed as the hose nears its fully raised position. A standard tool retrieval unit is not an acceptable product unless if offers these features. Mounted to the balancer shall be a 24V Micro Switch that, acting as a circuit breaker, is factory prewired to energize and de-energize the electromagnet upon contact with the striker plate positioned on the Horizontal Guide Rail. Also mounted on the balancer is a 6"-l 90º, 24-gauge coated steel elbow to join the Horizontal Suction Hose to the Upper Vertical Suction Hose.
2. Attached to the backsides of the balancer are all steel trolleys that insert into the Horizontal Guide Rail to facilitate ease of movement of the Balancer Assembly. The trolley framework shall be welded and be constructed of minimum .25" hardened steel and fitted with no less than six steel ball bearing rollers.

F. Striker Plate

1. Affixed to the exit of the Guide Rail, the Striker Plate shall be made of galvanized steel. The design shall provide reliable contact with the Micro Switch arm.

G. End Stop

1. The Guide Rail shall be equipped with an End Stop that is designed to provide a "cushioned" halt to the moveable hose/balancer assembly during the exit runs. This shall be accomplished by use of a coil spring that is inserted inside of the Horizontal Guide Rail, and then bolted into place.

H. Electromagnet Assembly

1. The electromagnet assembly shall consist of an electromagnet disc, a manual override switch, and an anchor plate that shall be used as the means to keep the entire hose and nozzle assembly attached to the vehicle while in the building. The electromagnet shall have a power supply that is DC voltage, at 24V. The current shall be supplied from transformer to the electromagnet disc assembly by means of two wires inside the helix.
2. The electromagnet disc shall be supplied within a hard, resilient plastic cup that is tapered to facilitate ease of attachment to the vehicles anchor plate. It shall be integrally mounted to the Lower Vertical Hose in such a manner as it will not scratch the vehicle or catch on any exposed item.

3. The manual override switch shall be located on the Lower Vertical Hose. It shall be spring operated and have a UL and CSA Approved rating for 6A, 250VAC. The switch shall be in a protective position to assure that it will not scratch the vehicle or catch on any exposed item.
4. The anchor plate shall be attached to the vehicle and mounted in a hard resilient plastic that is tapered to allow for ease of attachment. Two predrilled holes to facilitate screws and/or industrial grade double-stick tape shall be provided as means for attachment to the vehicle. The anchor plate position from the tailpipe shall be between 5" and 10" beyond the vertical centerline, towards the front of the vehicles and from 31" to 39" upward from the tailpipe's centerline.
5. The electromagnet shall be powered by line voltage to a J-box. The mechanical contractor shall provide a J-box with 120v to 24v transformer to power magnetic J-box shall be anchored securely.

I. Lower Vertical Hose

1. The Lower Vertical Hose shall be 6" in diameter. The material of the hose shall be of a Neoprene coated terylene fabric and vulcanized. The hose shall be fire resistant according the DIN 4102 B1 ratings. The hose shall be capable of withstanding temperatures of 340° F continuously and up to 370° F intermittently. Hose shall have a compression ratio of 6:1. The helix shall be made of galvanized steel and completely covered to protect from scratching the vehicle.

J. Nozzle

1. The nozzle shall be designed so as to utilize dynamic tension in conjunction with the Lower Vertical Hose and Electromagnet Assembly to secure itself to the tailpipe. The nozzle shall be of EPDM rubber to assure it does not scratch the vehicle. It shall have an 8" diameter inlet area to allow for ease of attachment to the tailpipe to allow for adequate ambient air supply so as to minimize the effects of hot exhaust on the hose and nozzle. A built-in spring will serve to keep the nozzle properly angles from the Lower Vertical Hose in order to accommodate ease of being sleeved over the tailpipe during hook-up. In addition, the spring aids in the dynamic tension connection of the nozzle to the vehicle. Two friction pads shall be utilized on the bottom of the nozzle inlet to aid in the ease of release from the vehicle by the nozzle during exit. A wire mesh screen must be provided inside the nozzle to assure no debris enters the exhaust system.

K. Approved Manufacturers

1. Nederman Magnatrack
2. No exceptions.

PART 3 - EXECUTION

3.1 GENERAL

A. Certain components of the system shall have the capabilities to move with the vehicle, within the building, while the exhaust nozzle device remains mounted to the tailpipe.

B. The exhaust fan shall automatically activate and after *approximately* a 2 minute cycle time, automatically shut-off. A fan timer override shall be incorporated to allow for longer run times during apparatus checks, etc.

C. Disconnection from the vehicle shall be accomplished by a combination of the de-energization of the 24V electromagnet, gravity, and the pulling action from the hose retrieval device.

D. Installation shall be in accordance with applicable codes and regulations. Workmanship shall be of the highest caliber and be in accord with recommendations outlined in the Product Installation Manual. Any variations from the Installation Manual must be approved in writing by the manufacturer's agent.

END OF SECTION 233429

SECTION 233431 - WELDING EXHAUST ARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. The 7’ Original Fume Extractor Arm shall have a 360° swivel elbow, a support flange, internal support, pre-set joints with wear discs that can be adjusted if required, fiberglass reinforced PVC hose (6¼"), oval polycarbonate hood (10' x 12'), quiet damper with positive seal.

B. The 7’ Fume Extractor Arm shall have a 360° swivel elbow (less movement when the Fume Extractor Arm is wall mounted); a 180° vertical friction joint; a 230° vertical friction joint; and a four-way friction joint, 180° + 220°, at the hood. The 7’ Fume Extractor Arm shall have a total reach (from the center point of the Extractor Arm outlet to the center point of the Extractor Hood) of 6'-6¾".

C. The material structure of the 7’ Fume Extractor Arm shall consist of the following: Hood shall be made of Polycarbonate (PC) designated “Makrolon” UL E41613 (M) Card B; the suspension Ring shall be made of die-casted, (ALSi9Cu3), ASTM B26 (B179) : SC84A; the Damper shall be made of polyamide (nylon); the Internal Tubes shall be made of aluminum extruded, Aluminum Association (AA) “Registration record of International Alloy Designation” 6063; the Tube Bend and Flange shall be made of Aluminum die-casted, (ALSi9Cu3), ASTM B26 (B179) : SC84A and SC12C; the Friction Discs shall be made of brake lining material (asbestos free); the Hose shall be made of a woven glass fabric with external and internal PVC lamination, the hose shall be supported by spirally wound steel wire helix; the Decor Ring shall be made of EPDM rubber (Ethylenepropylene diene mononer); the Elbow Swivel Gasket shall be made of PVC (polyvinyl chloride); the Friction Discs in the Hood shall be made of phenolic plastic.

D. NIF Series 500 Specifications

1. Centrifugal Belt Drive fans shall be provided by Nederman, Inc. of Westland, Michigan. The series and model shall be NIF Series 500, Model NIF 504-3, Arrangement 9, Cw Upblast. Capacity rated for_____cfm at_____“Static Pressure at standard conditions. Operating conditions:_____°F,_____Ft. altitude.
2. Motor shall be 10 H.P., TEFC, with 3ph. 60Hz, 208-230/460V electrics. Blower wheel shall be belt drive operating at_____rpm.
3. Backward inclined wheel shall have welded blades, single thickness. To assure smooth operation, wheels shall be dynamically balanced. All fans shall be test run at the factory before shipping. Shafts shall be turned, ground and polished.

4. Housings shall be heavy duty 10 gauge steel, continuously welded and supported to prevent housing pulsation at all conditions. V-belt selection is for a minimum of 1.3 times normal horsepower. All bearings shall be heavy-duty, lubricated, self-aligning ball bearing.
5. (All parts in contact with airstream shall be standard steel, aluminum or stainless steel as specified)
6. Before painting, all steel shall be cleaned by detergent wash, phosphated and painted with machine gray enamel.

END OF SECTION 233431

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to:

1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents.

B. Related Sections:

1. Section 233001: General Duct Requirements.

1.2 MAINTENANCE

A. Extra Materials: Leave tool for removing core of each different type of grille for building custodian.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Supply Grilles and Registers:

1. Finish: Off-white baked enamel.
2. Removable core.
3. Category Four Approved Products. See Section 010000 for definitions of Categories.
   a. Carnes
   b. J & J
   c. Krueger
   d. Metal*Aire
   e. Nailor
   f. Price
   g. Titus
   h. Tuttle & Bailey.
   i. Greenheck

B. Ceiling Return and Transfer Grilles:

1. Finish: Off-white baked enamel.
2. ½" spacing.
3. Category Four Approved Products. See Section 010000 for definitions of Categories.
   a. Carnes
   b. J & J
   c. Krueger
   d. Metal*Aire
   e. Nailor
   f. Price
   g. Titus
   h. Tuttle & Bailey

i. Greenheck

C. High Side Wall Return Grilles:

1. Finish: Off-white baked enamel.
2. Category Four Approved Products. See Section 010000 for definitions of Categories.
   a. Carnes
   b. J & J
   c. Metal*Aire
   d. Krueger
   e. Nailor
   f. Price
   g. Titus
   h. Tuttle & Bailey
   i. Greenheck

D. Floor Return Grilles:

1. Finish: Clear anodized.
2. Category Four Approved Products. See Section 010000 for definitions of Categories.
   a. Carnes
   b. J & J
   c. Krueger
   d. Metal*Aire
   e. Nailor
   f. Price
   g. Titus
   h. Tuttle & Bailey
   i. Greenheck

E. Low Sidewall Return Grilles:

1. Finish: Off-white baked enamel.
2. 38° or 45° deflection.
3. Category Four Approved Products. See Section 010000 for definitions of Categories.
   a. Carnes
   b. J & J
   c. Krueger
   d. Metal*Aire
   e. Nailor
   f. Price
   g. Titus
   h. Tuttle & Bailey
   i. Greenheck

F. Soffit Grilles:

1. Finish: Baked enamel. Match soffit color.
2. Aluminum with aluminum mesh insect screen.
3. Category Four Approved Products. See Section 010000 for definitions of Categories.
   a. Carnes
   b. J & J
   c. Krueger

d. Metal*Aire
e. Nailor
f. Price
g. Titus
h. Tuttle & Bailey
i. Greenheck

G. Ceiling Diffusers:

1. Finish: Off-white baked enamel.
2. Category Four Approved Products. See Section 010000 for definitions of Categories.
   a. Carnes
   b. J & J
   c. Krueger
   d. Metal*Aire
   e. Nailor
   f. Price
   g. Titus
   h. Tuttle & Bailey
   i. Greenheck

H. CEILING SLOT DIFFUSERS

1. Roberston LLC, only approved. (208) 562-1360 (ask for Brent Robertson)

2.2 MANUFACTURERS

A. Contact Information:

1. Carnes Co, Verona, MI www.carnes.com
2. J & J Register, Holland, MI www.jandjreg.com.
3. Krueger Air System Components, Richardson, TX www.krueger-hvac.com.
4. Metal*Aire by Metal Industries Inc, Clearwater, FL www.metalaire.com.
5. Nailor Industries Inc, Houston, TX or Weston, ON www.nailor.com.
6. Price Industries Inc, Suwanee, GA www.price-hvac.com.
7. Titus, Richardson, TX www.titus-hvac.com.
8. Tuttle & Bailey, Richardson, TX www.tuttleandbailey.com.
9. Greenheck www.greenheck.com

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor securely into openings. Secure frames to ductwork by using four sheet metal screws, one per side. Level floor registers and anchor securely into floor.

3.2 ADJUSTING

A. Set sidewall supply register blades at 15° upward deflection.

END OF SECTION 233713

SECTION 233714 - LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but not limited to:

1. Furnish and install louvers connected to ductwork as described in Contract Documents.

B. Products supplied but not installed under this section:

1. Architectural louvers not connected to ductwork.

C. Related Sections:

1. Section 062001: Installation of architectural louvers not connected to ductwork.
Select from the following:
2. Section 233114: Low Pressure Steel Ductwork
3. Section 233115: Ductwork

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Louvers:

1. General:
   a. Extruded aluminum, with blades welded or screwed into frames.
   b. Frames shall have mitered corners.
   c. Louvers shall be recessed, flanged, stationary, or removable as noted on Drawings.
   d. Finish:
      1) Polyvinyledene Fluoride (PVF2) Resin-base finish (Kynar 500 or Hylar 5000) containing 70% minimum PVF2 in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and topcoat factory applied over properly pre-treated metal.
      2) Color as selected by Architect from Manufacturer's standard colors.

2. Louvers connected to ductwork:
   a. ½" mesh 16 ga aluminum bird screen.
   b. Category Four Approved Products. See Section 01 6000 for definitions of Categories.
      1) Air Control Products.
      2) Airolite.
      3) American Warming & Ventilating.
      4) Arrow United Industries.
      5) Carnes.
      6) Cesco.
      7) Industrial Louvers.
      8) Ruskin.
      9) Vent Products.
      10) Wonder Metals.Architectural Louvers:
   c. Aluminum bug screen.

d. Category Four Approved Products. See Section 01 6000 for definitions of Categories.
   1) Airolite.
   2) American Warming & Ventilating.
   3) Equals by Air Control Products, Arrow United Industries, Carnes, or Industrial Louvers as approved by Architect before installation. See Section 016000.

2.2 MANUFACTURERS

A. Contact Information:

1. Air Control Products, Salt Lake City, UT (800) 245-2252 or (801) 262-9933.
2. Airolite Co, Marietta, OH www.airolite.com.
3. American Warming & Ventilating, Holland, OH www.awv.com.
4. Arrow United Industries, Wyalusing, PA www.arrowunited.com.
5. Carnes Co, Verona, WI www.carnes.com.
6. Cesco Products, Minneapolis, MN www.cescoproducts.com.
7. Industrial Louvers Inc, Delano, MN www.industriallouvers.com.
8. Ruskin Manufacturing, Kansas City. MO www.ruskin.com.
9. Vent Products Co Inc, Chicago, IL www.ventprod.com.
10. Wonder Metals Corp, Redding, CA www.wondermetals.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor securely into openings.

B. Where louvers touch masonry or dissimilar metals, protect with heavy coat of asphaltum paint.

END OF SECTION 233714

SECTION 234100 - DISPOSABLE AIR FILTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Filters other than in air handling units specified in Sections specifying equipment in which filters are installed.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install filters used in air handling units.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNIT FILTERS

A. 2” or 4” thick, medium efficiency, disposable type pre-formed pleated design, having at least 4.5 ft^2 of filtering media per ft^2 of face area.

B. Media shall be reinforced non-woven cotton fabric, treated with adhesive similar to "Vyclad B" and continuously laminated to supporting steel wire grid conforming to configuration of pleats.

C. Media pack shall be sealed in a chipboard frame or beverage board.

D. Filters shall have rated average efficiency of 30 to 35% (MERV 8) on ASHRAE Test Standard 52-76 and be capable of operating with variable face velocities up to 500 FPM without impairing efficiency.

E. Initial resistance shall not exceed 0.30” w.g. at 500 FPM or 0.14” w.g. at 300 FPM. Filter shall be listed Class 2 by UL.

F. Approved Manufacturers

1. Type 30/30 by Farr Co
2. Mark 80 by Serv-Aire
3. HC Type 40 by Envopleat
4. DP2-40 by Air Guard

END OF SECTION 23 4100

SECTION 235133 - COMBUSTION AND EXHAUST AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section 221116: Pipe and pipe fittings and practices

D. Section 230553: Mechanical Identification

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install heating equipment exhaust piping and combustion air intake piping as described in Contract Documents and heater manufacturer's venting materials requirements.

1.3 REFERENCES

A. American Society for Testing and Materials

1. ASTM D 1785-99, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.'
2. ASTM D 2564-96a, 'Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.'
3. ASTM D 2661-97a, 'Standard Specification for Acrylonitrile-butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings.'
4. ASTM D 2665-00, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Air Piping: Schedule 40 pipe and fittings meeting requirements of ASTM D 1785, ASTM D 2661, or ASTM D 2665.

B. Piping Primer and Cement: Meet requirements of ASTM D 2654.

C. Flexible Foamed Pipe Insulation

1. Thickness:
   a. ½" for 2 through 3" outside diameter pipe.
   b. ½" sheet for fittings as recommended by Manufacturer.

2. Approved Products:
    a. Tubalok by Armaflex.
    b. ImcoLock or ImcoShield by IMCOA.
    c. Therma-Cel by Rubatex.

D. Insulation Joint Sealer

1. Approved products:
    a. 520 by Armaflex.
    b. Construction Adhesive No. 105 by BFG.
    c. 950 Therma-Cel by Rubatex.

2.2 MANUFACTURERS

A. Contact Information:

1. Armaflex by Armacell, Mebane, NC (800) 232-3341. www.armaflex.com
2. BFG industries, West Columbia, SC (800) 845-2220 or (802) 796-1380.
3. IMCOA, Haltom City, TX (800) 535-5078 or (817) 485-5290. www.imcoa.com
4. Rubatex, Roanoke, VA (800) 782-2839 or (540) 561-6000. www.rbxcorp.com

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation For Condensing Furnaces

1. Run individual vent and individual combustion intake piping from each furnace to concentric roof termination kit provided by Furnace manufacturer. Slope lines downward toward furnace.
2. Slop combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.
3. Use concentric roof termination kit provided by Furnace Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Furnace Manufacturer.
4. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
5. Ensure that factory-supplied perforated metal disc is installed in flexible coupling, unless its removal is required.
6. Furnace flue outlet shall be located 10’ from any mechanical air intake.

B. Installation For Condensing Water heaters:

1. Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Concentric roof termination kit may be used if approved by and provided by Water heater Manufacturer. Slope lines downward toward water heater.
2. Slope combustion chamber exhaust drain downward to floor drain.
3. Furnace flue outlet shall be located 10’ from any mechanical air intake.

C. Support:

1. Support concentric roof termination kit at ceiling or roof line with 20 ga sheet metal straps as detailed on Drawings.

2. Support horizontal sections of pipe in accordance with requirements of Section 220529. Anchor securely to structure, not allowing pipe to sway.

D. Insulation:

1. General:
   a. Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.
   b. Slip insulation on piping before piping sections and fittings are assembled keeping slitting of insulation to a minimum.
   c. Joints:
      1) Place 'slit' joint seams of insulation exposed outside building on bottom of pipe.
      2) Stagger joints on layered insulation.
      3) Seal joints in insulation.
   d. Paint exterior exposed insulation with two coats of finish recommended by Insulation Manufacturer, color selected by Architect.

2. Install specified insulation on PVC air piping serving mechanical equipment as follows:
   a. Combustion air PVC piping in truss space and in attic.
   b. Combustion vent PVC piping in attic, in truss space, and above roof.
   c. Insulate fittings with sheet insulation and as recommended by Manufacturer.

END OF SECTION 235133

SECTION 235134 - FLUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Division 09 - Painting

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install flues as described in Contract Documents.

PART 2 - PRODUCTS

2.1 FLUES

A. Double wall, prefabricated sectional type 'B', of aluminum construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing, and clean-out.

1. Height of flue above roof shall be as shown on Drawings unless local code requires it be higher.
2. Size and install flues from furnaces according to local codes except as follows
   a. No vertical flue shall have an area of less than 12½ in^2 (4” round).
   b. In no case shall vent connector from furnace be smaller than outlet collar provided by Manufacturer.
3. Every portion of flue connector shall rise 1” per ft minimum from appliance to vertical flue.
4. Length of horizontal flues or flue connectors shall not be longer than 75% of height of vertical flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall horizontal run exceed 15’.
5. When two or more flue connections enter common vertical flue, smaller flue connector shall enter at a higher level. Do not enter flue connectors in same horizontal plane.
6. Horizontal flue connectors shall be double wall.
7. Fittings shall be prefabricated double wall.
8. Every gas appliance flue shall have a "backdraft preventer" installed at top of flue.

B. Approved Manufacturers

1. Ameri-Vent
2. Dura-Vent
3. Metalbestos

2.2 VENT CAPS

A. Non-backdraft type for installation on top of flue, aluminum construction.

B. Approved Manufacturers

1. Ameri-cap
2. Breidert Type L
3. Triangle AFL
4. Acme Mastervent Type MVR.
5. Dura-Vent

END OF SECTION 235134

SECTION 235135 - AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501: Basic Mechanical Materials and Methods sections apply to work of this section.

C. Sections Under 09 - Painting.

D. Section 221116: Domestic Pipe and Pipe Fittings and Practices.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install heating equipment exhaust piping and combustion air intake piping as described in Contract Documents.

1.3 REFERENCES

A. American Society for Testing and Materials

1. ASTM D 1785-99, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.'
2. ASTM D 2564-96a, 'Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.'
3. ASTM D 2661-97a, 'Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings.'
4. ASTM D 2665-00, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Air Piping: Schedule 40 pipe and fittings meeting requirements of ASTM D 1785, ASTM D 2661, or ASTM D 2665.

B. Piping Primer and Cement: Meet requirements of ASTM D 2564.

C. Flexible Foamed Pipe Insulation

1. Thickness
   a. ½” for 2” through 3” outside diameter pipe.
   b. ½” sheet for fittings as recommended by Manufacturer.

2. Approved Products
    a. Tubalok by Armaflex.
    b. ImcoLock or ImcoShield by IMCOA.
    c. Therma-Cel by Rubatex.

D. Insulation Joint Sealer

1. Approved Products
    a. 520 by Armaflex.
    b. Construction Adhesive No. 105 by BFG.
    c. 950 Therma-Cel by Rubatex.

2.2 MANUFACTURERS

A. Contact Information

1. Armaflex by Armacell, Mebane, NC (800) 232-3341. www.armaflex.com
2. BFG Industries, West Columbia, SC (800) 845-2220 or (803) 796-1380.
3. IMCOA, Haltom City, TX (800) 535-5078 or (817) 485-5290. www.imcoa.com
4. Rubatex, Roanoke, VA (800) 782-2839 or (540) 561-6000. www.rbxcorp.com

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation for Condensing Furnaces:

1. Run individual vent and individual combustion intake piping from each furnace to concentric roof termination kit provided by Furnace Manufacturer. Slope lines downward toward furnace.
2. Slope combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.
3. Use concentric roof termination kit provided by Furnace Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Furnace Manufacturer.
4. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
5. Ensure that factory-supplied perforated metal disc is installed in flexible coupling unless its removal is required.

B. Installation for Condensing Water Heaters

1. Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Concentric roof termination kit may be used if approved by and provided by Water Heater Manufacturer. Slope lines downward toward water heater.
2. Slope combustion chamber exhaust drain downward to floor drain.

C. Support

1. Support concentric roof termination kit at ceiling or roof line with 20 ga sheet metal straps as detailed on Drawings.
2. Support horizontal sections of pipe in accordance with requirements of Section 15101. Anchor securely to structure, not allowing pipe to sway.

D. Insulation

1. General
   a. Install insulation in snug contact with pipe and in accordance with Manufacturer's recommendations.
   b. Slip insulation on piping before piping sections and fittings are assembled keeping slitting of insulation to a minimum.
   c. Joints
      1) Place 'slit' joint seams of insulation exposed outside building on bottom of pipe.
      2) Stagger joints on layered insulation.
      3) Seal joints in insulation.
   d. Paint exterior exposed insulation with two coats of finish recommended by Insulation Manufacturer, color selected by Architect.

2. Install specified insulation on PVC air piping serving mechanical equipment as follows
   a. Combustion air PVC piping in truss space and in attic.
   b. Combustion vent PVC piping in attic, in truss space, and above roof.
   c. Insulate fittings with sheet insulation and as recommended by Manufacturer.

END OF SECTION 235135

SECTION 235418 - NATURAL GAS FIRED FURNACES (90%)

PART 1 - GENERAL

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section: Refrigerant Piping System.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install vertical gas-fired condensing furnaces as described in Contract Documents.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Rated at 90% minimum AFUE (Annual Fuel Utilization Efficiency) calculated in accordance with DOE test procedures.

1.4 SUBMITTALS

A. Quality Assurance/Control: Equipment check-out sheets.

1.5 WARRANTY

A. Provide 15-year minimum limited warranty on heat exchanger.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Furnaces:

1. Factory assembled units certified by AGA complete with blower section, steel casing, piped, and wired.
2. Blower section shall consist of cabinet, blower, and motor.
   a. Cabinet shall be of 22 ga minimum cold rolled steel and have finish coat of baked-on enamel.
   b. Blower shall be Class 1, full DIDW, statically and dynamically balanced.

3. Automatic controls shall consist of:
   a. 100% cut-off safety pilot.
   b. Manual gas shut-off valve.
   c. Operating automatic gas valve.

d. Solid-state type fan and thermal limit controls.
e. 24-volt transformer.
f. Electronic ignition system.

4. Blower shall be driven by motor with adjustable pitch V-belt drive or by multi-speed direct driven motor.
5. Furnace section shall be enclosed in 22 ga minimum enameled steel casing lined with foil covered insulation.
6. Heat exchanger; Aluminized Steel.
7. Gas Burners: Aluminized steel.
8. PVC intake of outside air and PVC combustion product exhaust, with sealed combustion, direct vent system.
9. Concentric roof termination kit for roof mounting.
10. Approved Products:
    a. Standard furnaces:
        1) Carrier 58 MXA/Bryant 350 MAV
        2) Lennox 651MP.
        3) Trane TUXC.
        4) York P3DH.
    b. Two-Stage Furnaces
        1) Carrier 58 MTA/Bryant 352 MAV.
        2) Lennox G61MP.
        3) Trane TUXR.
        4) York P1X.

B. Cooling Coil

1. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish it match furnace.
    a. Coil shall have aluminum fins bonded to seamless copper tubing.
    b. Coil shall be ARI rated. Provide drain pans with connections at one end.
    c. Use thermal expansion valve with brazed joints in place of capillary tube metering device. Compression fittings not acceptable.
    d. Do not include cooling coil and coil cabinet on furnaces serving zones where cooling is not required.

2. Approved Products:
    a. Horizontal:
        1) Carrier/Bryant CK3B.
        2) Lennox CH23 or CH33.
        3) Trane TXC.
        4) York G1HA, G2FD.
    b. Vertical:
        1) Carrier/Bryant CK5A.
        2) Lennox C26.
        3) Trane TXC.
        4) York G1FA, G2FD.

2.2 ACCESSORIES

A. Build filter frame external to furnace as detailed on drawings.

B. Vibration Isolators:

1. Horizontal Installation.
   a. Neoprene hanger type with load of 75 lbs maximum.
   b. Approved Products:
      1) RH by Kinetics Noise Control.
      2) HD by Mason Industries.
      3) RH by Vibration Mounting & Controls.

2. Vertical Installation: 4 in² by ½" thick minimum neoprene type vibration isolation pads.

2.3 MANUFACTURERS

A. Contact Information

1. Carrier Corp, Syracuse, NY (800) 227-7437 or Carrier Canada Ltd/Ltee, Mississauga ON (905) 826-9508.
2. Kinetics Noise Control, Dublin, OH (800) 959-0191 or (514) 889-0480 www.kineticsnoise.com
3. Lennox Industries, Dallas, TX (972) 497-5000 or Lennox Industries (Canada) Ltd. Etobicoke, ON (416) 621-9302.
4. Mason Industries, Hauppauge, NY (516) 348-0282 www.mason-ind.com
5. Trane, La Crosse, WI (800) 288-7263.
6. Vibration Mounting & Controls, Bloomingdale, NJ (800) 569-8423 or (973) 838-1780 www.vmc-kdc.com
7. York International, York, PA (800) 368-0465.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install vibration isolator on each hanger rod supporting horizontal furnace and under each corner of vertical furnace.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service

1. Furnace distributor's technical service representative shall:
   a. Verify proper gas orifice size.
   b. Clock gas meter for rated input.
   c. Verify and set gas pressure at furnace.
   d. Check and measure temperature rise.
   e. Check safety controls for proper operation.
   f. Check combustion vent sizes and combustion air sizes.

B. In addition, furnace distributor's technical service representative shall start up, check out, and adjust furnaces using equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet.

END OF SECTION 235418

SECTION 23 5420 - ROOFTOP GAS HEATING/ AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install packaged air conditioning units as described in Contract Documents.

1.3 SUBMITTALS

A. Warranty

1. Submit copy of specified warranty.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements

1. Air-Cooled Condensing Unit Section shall be UL approved and rated according to ARI Standards.
2. Air delivery of units certified in accordance with standard test code for centrifugal fans adopted by AMCA.
3. Furnace sections shall be AGA approved.

1.5 DELIVERY, STORAGE, & HANDLING

A. Ship units with lifting angles and fully charged with refrigerant R-410A.

1.6 SEQUENCING & SCHEDULING

A. Coordinate installation of specified accessories with Section 230501-3.14.

1.7 WARRANTY

A. 5 year warranty on compressors.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Units shall be completely factory assembled and tested.

1. Units shall include following
   a. Condenser coils
   b. Condenser fans and motors
   c. Interconnected wiring
   d. Prewired control panel
   e. Filter section
   f. Factory installed 100% modulating economizer cycle including motorized dampers and controls.
   g. Corrosion resistant all-weather cabinet
   h. Roof curb.
   i. Disconnect and outlet.

B. Air-Cooled Condensing Unit Section

1. Unit shall contain a strainer-dryer.
2. Furnish unit with time delay or cycle protection to prevent short cycling.
3. See equipment schedule for rated ARI EER/SEER.

C. Condenser Coil -

1. ½" outside diameter copper tube with aluminum fins.

D. Compressor

1. Hermetic or semi-hermetic type mounted on vibration isolators.
2. Equip with crankcase heater.

E. Condenser Fan

1. Axial flow type propeller fan.

F. Refrigerant lines shall have

1. Flexible connections
2. Suction and liquid line service valves
3. Charging valves
4. Receiver valve

G. Controls

1. Low ambient and dual pressure. Pre-wired.

H. Furnace Sections

1. Aluminized or chromized heat exchanger.
2. Built-in draft diverter.
3. Gas shut-off valve.
4. High limit switches.

5. Fan switch safety pilot and control transformer.
6. Automatic electric ignition.
7. Provide orifice for LP fuel.
8. 80% AFUE/Thermal Efficiecy.

I. Fan Section

1. Centrifugal Fan - One or more.
   a. Double inlet.
   b. Double width forward curved Class I.
   c. Constructed and tested in accordance with AMCA requirements.

2. Furnish with flexible connections with weather protection on supply and return air take-offs.

J. Economizer - Horizontal

1. This accessory shall be either field or factory installed. The assembly includes - fully modulating 0 – 100% motor and dampers, minimum position setting, preset linkage, wiring harness with plug and fixed dry bulb control. Solid state enthalpy and differential enthalpy control shall be a factory-supplied, field-installed accessory. The factory-installed economizer arrives in the shipping position and shall be moved to the operating position by the installing contractor.
   a. Install contractor shall install a barometric relief damper in the return duct.

K. Refrigerant Coils

1. Constructed of copper tubes with mechanically bonded aluminum plate fins.
2. 1" filter rack with locking hinged door.

L. Cabinets

1. Galvanized, weather-proof, and coated inside and outside with corrosion-resistant paint.

M. Roof Curb

1. 14” high minimum.

N. Approved Manufacturers

1. Carrier
2. Lennox
3. Trane
4. Bryant

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units on spring type vibration isolators.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service

1. Equipment Manufacturer to provide start-up service.

END OF SECTION 235420

SECTION 235513 - NATURAL GAS DUCT FURNACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Refer to Section 231123.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install duct furnaces as described in Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. AGA approved, equipped for natural gas, and complete with -

1. Type E3, 409, 430, or 321, stainless steel or ceramic coated heat exchanger.
2. Drain pan.
3. Controls.
4. Gas burner.
5. Steel casing with baked-on enamel finish.
6. Power venter

B. Controls

1. For two-stage (high-low flame) operation.
2. Factory installed and include
    a. Manual gas shut-off valve.
    b. Limit control.
    c. Thermally actuated fan control.
    d. Operating automatic gas valve.
    e. 100% shut-off safety pilot.
    f. Gas pressure regulator.
    g. Transformer.
    h. Electronic ignition.

3. Limit control shall be located ahead of valve on hot side of power source.
4. Electric Controls
    a. Factory wired in flexible conduit.

5. Easily accessible and mounted at bottom-front, bottom-front rear, or on accessible side of furnace.

C. Burners

1. Of die-formed aluminized steel with stainless steel ribbon inserts.

D. Approved Manufacturers

1. Janitrol
2. Modine
3. Reznor
4. Trane
5. Hastings
6. Sterling

END OF SECTION 235513

SECTION 235533 - GAS UNIT HEATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Gas fired, separated-combustion unit heaters

1. Provide high-efficiency, separated-combustion, gas-fired nit heaters manufactured as Reznor brand units. They are to be designed for fuel use improvement of 25% and engineered for use in building areas with negative pressure and/or extremely dirty of mildly corrosive atmospheres. The use of a factory-installed power venter to draw combustion air from outside is to prevent dirt, line, dust, or other contaminants present in the heated space from entering the unit. The combustion air supply pipe and flue exhaust pipe shall be run parallel to a factory supplied (horizontal) (vertical) vent terminal assembly. The terminal assembly shall be concentrically arranged to allow for a single wall or roof penetration.

B. Model SFT - Propeller fan, separated-combustion model with tubular heat exchanger

1. Each Model SFT series unit shall be equipped for use with (natural) (propane) gas and 120/1-volt power supply. The heater shall be equipped with tubular aluminized steel heat exchanger and a removable aluminized steel burner rack including an assembly of inshot burners. The units shall be designed to provide 80% thermal efficiency.
2. Standard controls include a single-stage gas valve, direct spark ignition with 100% shutoff, a fan motor, a power venter motor and wheel assembly, a combustion air pressure switch, and a safety limit switch. Operation is controlled an integrated circuit board that includes and LED diagnostic indicator light. Supply voltage connections and 24-volt control connections are made at the circuit board. The low-profile cabinet has a baked enamel and galvalume steel finish and is designed for ceiling suspension from four 3/8" - 16 threaded hangers. The cabinet is equipped with horizontal (vertical) louvers (downturn nozzles) for directing air flow.
3. Model SFT Sizes 45, 60, and75 are certified to IAS requirement 10-96 for RESIDENTIAL INSTALLATION. All sizes are design certified by the American Gas Association and approved by the Canadian Gas Association for commercial/industrial application.

C. Model SCA - Propeller fan, separated-combustion model

1. Each Model SCA series unit shall be equipped for use with (natural) (propane) gas and (120/1) (208/1) (208/3) (460/3) volt power supply. The heater shall be equipped with a Thermocore design heat exchanger of aluminized (E-3 stainless) (409 stainless) steel. Die-formed, aluminized steel burners include flared ports (burner air shutters) and a stainless-steel insert. The units shall be designed to provide 80% thermal efficiency.

2. Controls include a 24-volt control transformer; single-stage (two-stage) (electronic modulation) gas control system; intermittent spark pilot with electronic flame supervision (and timed lockout); fan and limit safety controls; a combustion air pressure differential switch to verify proper vent flow; an open, drip-proof fan motor with internal overloads; and a power venter motor and wheel assembly. The cabinet is equipped with a full safety fan guard and horizontal louvers for directing air flow. The unit is arranged for ceiling suspension with 2-point threaded hanger connections (hanger kits).
3. Model SCA unit heaters are design certified by the American Gas Association and approved by the Canadian Gas Association.

D. Model SCB - Centrifugal blower, separated-combustion model

1. Description
   a. Each model SCB series unit shall be equipped for use with (natural) (propane) gas and (120/1) (208/1) (208/3) (460/3) volt power supply. The heater shall be equipped with a Thermocore design heat exchanger of aluminized (E-3 stainless) (409 stainless) steel. Die-formed, aluminized steel burners include flared ports (burner air shutters) and a stainless-steel insert.
      1) Controls include a 24-volt control transformer; single-stage (two-stage) (electronic modulation) gas control system; intermittent spark pilot with electronic flame supervision (and timed lockout); fan and limit safety controls; a combustion air pressure differential switch to verify proper vent flow; an open, drip-proof (totally enclosed) blower motor with (internal) (external) overloads; and a power venter motor and wheel assembly. Each unit must be able to operate with .24" w.c. of external static pressure. The cabinet is equipped with horizontal louvers and may be equipped with (an OSHA-type blower and belt guard) and (vertical) louvers (downturn nozzles) for directing airflow. The unit is arranged for ceiling suspension with 2-point threaded hanger connections (hanger kits).
      2) Model SCB unit heaters are design certified by the American Gas Association and approved by the Canadian Gas Association.
   b. The Model SCB Series gas-fired, blower-type, separated-combustion, power-vented unit heaters are available in sizes ranging from 125,000 to 400,000 BTUH gas input for use with either natural or propane gas, as specified. Model SCB heaters are designed to separate their combustion air from the air in the heated space. These units are designed and manufactured in accordance with the ANSI definition of “separated combustion”. While discharging exhaust air, the power venter draws in combustion air from the outside atmosphere. Exclusive outside combustion air prevents dirt, lint, dust, or other contaminants in the heated space from entering the combustion zone of the heater. This separated combustion heater is designed for use in building areas with negative pressure and/or extremely dirty or mildly corrosive atmospheres. A specially designed combustion air inlet/vent terminal assembly supplied with the Model SCB heater allows for a single building penetration for both exhaust and combustion air.
      1) Standard features include a patented Thermocore heat exchanger with a venturi design tube and die-formed burners of aluminized steel with flared ports and a stainless-steel burner insert. Standard controls include a single-stage 24-volt gas valve, an intermittent safety pilot with electronic flame supervision, a blower motor with adjustable belt drive, a power venter motor and wheel assembly, a combustion air pressure switch, and a safety limit switch. The blower is capable of handling up to .24" w.c. of external static pressure. Each unit is arranged for field connection to a remote 24-volt thermostat for automatic operation. The heater cabinet is designed for suspension from two 1" couplings.

2) The Model SCB line of heaters is design-certified by the American Gas Association and approved by the Canadian Gas Association. Each unit displays either an A.G.A. or a C.G.A. label. Model SCB Series 6 heaters are 80% thermal efficient.
3) WARNING: Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, or atmospheres containing chlorinated or halogenated hydrocarbons. Installations in public garages or airplane hangars are permitted when in accordance with ANSI Z223.1 and NFPA 54 Codes or CAN1-B149 Codes and enforcing authorities.
4) NOTE: Regulated combination redundant gas valve consists of combination pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff, all in one body. Gas supply pressure must not exceed 0.5 psi (8 oz or 14" w.c.). Minimum inlet pressure for natural gas is 5' w.c.; minimum inlet pressure for propane gas is 11"w.c.

2. Standard Features
   a. Orifices for natural gas.
   b. Aluminized steel heat exchanger.
   c. Aluminized steel burner with stainless steel insert.
   d. Spark-ignited intermittent safety pilot with electronic flame supervision.
   e. Single-stage combination gas valve.
   f. 115/1/60 supply voltage.
   g. 115/1/60 blower motor with internal thermal overloads.
   h. 115/1/60 venter motor with stainless steel shaft.
   i. Motor contactor (Size 400).
   j. Fan and limit safety controls.
   k. ECO drive.
   l. Pressure switch to verify vent flow.
   m. 24-volt control voltage transformer.
   n. Individually adjustable horizontal louvers.
   o. Adjustable belt drive blower.
   p. Terminal block wiring.
   q. Burner Rack side access (pullout drawer; left side facing airstream).
   r. 2-point suspension (1" couplings).

3. Optional Features - Factory Installed.
   a. Equipped for propane gas.
   b. Equipped for high altitude.
   c. E-3 (409) stainless steel heat exchanger
   d. 321 Stainless steel heat exchanger.
   e. E-3 (409) stainless steel burners.
   f. Stainless steel bottom pan.
   g. Spark-ignited intermittent safety pilot with electronic flame supervision and timed lockout (required for propane gas).
   h. 208/230/1/60 208/230/460/575/3/60 supply voltage.
   i. 1/3-5HP Open and 1/4-3HP totally enclosed blower motors (See RPM/BHP Table on pages 28-29).
   j. Motor Starter.
   k. Two-stage gas valve (50%/100%).
   l. Burner air shutters (required with propane gas).
   m. Manual summer/winter switch.
   n. Electronic modulation.
   o. Air recirculation kits - See page 35 for descriptions.

p. Relay for summer fan operation.
q. Vertical louvers.
r. OSHA-type belt guard and blower inlet guard.
s. BX cable - ½" O.D. (Standard is 3/8" O.D.).
t. Right side controls (facing airstream).

4. Accessories - Field Installed
   a. Horizontal inlet air/vent terminal kit *.
   b. Vertical inlet air/vent terminal kit *.
   c. Downturn nozzles, 25-60° or 50-90° variable air deflection range.
   d. Manual shutoff valve and union.
   e. Thermostats (single stage and two stage).
   f. Thermostat guard with locking cover.

   * Selection of either a horizontal or vertical inlet air/vent terminal kit is required.
   NOTE: Not certified for residential use.

1.2 WARRANTY

A. Reznor Product Limited Warranty

1. Thomas & Betts Corporation warrants to the original owner-user that this Reznor product will be free from defects in material or workmanship. This warranty is limited to twelve (12) months from the date of original installation, whether actual use begins on that date, or eighteen (18) months from date of shipment
2. Extended Warranty (Limited to the following Models and Items).
   a. **Model SHE–** Extended four (4)-year, non-prorated warranty on the primary heat exchanger, and two (2)-year, non-prorated warranty on the secondary heat exchanger and burners.
   b. **Models F and B**–Extended nine (9)-year, non-prorated warranty on the heat exchanger, burners, draft hood, and flue baffle assembly. Extended four (4)-year, non-prorated warranty on all electrical and mechanical operating components (with the exception of blower belts on Model B).
   c. **Models FE and BE–**Extended none (9)-year, non-prorated warranty on the heat exchanger, burners, and flue collection box assembly. Extended four (4)-year, non-prorated warranty on all electrical and mechanical operating components (with the exception of blower belts on Model BE).
   d. **Model FT–**Extended nine (9)-year, non-prorated warranty on the heat exchanger, burners, and flue collection box assembly. Extended four (4)-year, non-prorated warranty on all electrical and mechanical operating components.
   e. **Model SFT–**Extended nine (9)-year, non-prorated warranty on the heat exchanger, burners, and flue collection box assembly. Extended four (4)-year, non-prorated warranty on all electrical and mechanical operating components.
   f. **Model SCA and SCB (purchased after 10/31/92)–**Extended four 94)-year, non-prorated warranty on the heat exchanger, burners, and all electrical and mechanical operating components (with the exception of blower belts on Models SCB).
   g. **Models OH and OB (purchased after 2/28/94)–**Extended four (4)-year, non-prorated warranty on the heat exchanger and combustion chamber.

3. Limitations and Exclusions

Thomas & Betts Corporation's obligation under this warranty is limited to repair or replacement at its manufacturing facility of any part or parts of this Reznor product identified by model or serial number which shall be returned to Thomas & Betts Corporation with transportation charges prepaid and which the manufacturer's examination shall disclose to its satisfaction to be defective. Reznor parts or products will not be accepted at the manufacturing facility without an attached Return materials Tag. Repaired or replacement parts will be shipped by the Thomas & Betts Corporation facility, F.O.B. shipping point.

a. This warranty does not cover labor or other costs incurred in repairing, removing, installing, servicing, or handling of parts or complete products.

b. This warranty will not apply if the input to the product exceeds the rated input as indicated on the nameplate by more than 5%, or if the product in the judgement of the manufacturer has been subjected to misuse, negligence, accident corrosive atmospheres, atmospheres containing any contaminant (silicone, aluminum oxide, etc), excessive thermal shock, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to the manufacturer's printed instructions, or if the serial number has been altered, defaced or removed.

c. Thomas & Betts Corporation shall not be liable for any default or delay in performance of its warranty obligations hereunder caused by any circumstances beyond its control, including but not limited to judicial or government restrictions or restraints, strikes, fires, floods, or reduced supplies of raw materials, energy, or parts.

d. To the maximum extent provided by law, Thomas & Betts Corporation will not be liable for any loss, damage, cost of repair, or incidental or consequential damages of any kind in connection with the sale, use, or repair of any Reznor products. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, AND THOMAS & BETTS CORPORATION DISCLAIMS ALL OTHER EXPRESS WARRANTIES AND ALL IMPLIED WARRANTIES INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE.** No person is authorized to assume for Thomas & Betts Corporation any other warranty, obligation, or liability for any Reznor products.

END OF SECTION 235533

SECTION 235705 - SPLIT TYPE HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install heat pumps as described in Contract Documents.

1.3 SUBMITTALS

A. Warranty

1. Submit copy of specified warranty.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies -

1. Each unit shall be UL or ETL labeled.

1.5 WARRANTY

A. Five-year warranty on compressors with permanent label on unit showing expiration date.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Indoor Units

1. Compact wall & ceiling mounted units.
2. Supplementary electric heater, size as scheduled.
3. Cabinet Finish as selected by Architect.
4. Isolate moving parts from cabinets to reduce noise.
5. Built-in condensate pump.
6. Flared refrigeration connections.
7. 360º airflow panel.
8. Fresh air intake connection.

B. Outdoor Units

1. Compressor shall be of rotary design.

2. Fans shall be direct driven and discharge horizontally.
3. Casing shall be fully weatherproof for outdoor installations.
4. Microprocessor Controls shall be factory wired with programmable field wired remote thermostat.
5. Refrigerant shall be R-410A.
6. Isolate moving parts from cabinets to reduce noise.
7. Use dry-charged tubing for connection of unit's refrigerant system.
8. Heat pump 12” high stand.

C. Approved Manufacturers & Models

1. Mitsubishi Electric
2. Sanyo Electric Inc
3. Lennox
4. Carrier
5. Trane
6. LG
7. Daikin
8. Fujitsu

PART 3 - EXECUTION

3.1 Field Quality Control

A. Manufacturer's Field Service-

1. Heat pump units shall be started up, checked out, and adjusted by Unit Manufacturer's authorized factory trained service mechanic.
    a. Mechanic shall use check-out sheet provided by Manufacturer, complete and sign all items on sheet, and submit to Architect.
    b. Install, anchor and support heat pump, piping, fan coils, controls, and power. Installation shall be clean looking in appearance.
    c. Final payment will not be made until check-out sheet is received by Area Office.

END OF SECTION 235705

SECTION 236213 - AIR-COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of this section.

C. Division 03 - Concrete slab

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install condensing units as described in Contract Documents.

1.3 SUBMITTALS

A. Warranty

1. Submit copy of specified warranty. Include warranty in Operations & Maintenance Manual. See Section 230501.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Each unit shall be UL labeled.
2. Condenser coil shall comply with Standard ASTM B117.

1.5 WARRANTY

A. Five-year warranty on compressors.

1. Warranty time frame shall be five years from date of "startup". "Startup" date shall be recorded on warranty certificate for each unit.

PART 2 - PRODUCTS

2.1 7-1/2 TON & LARGER UNITS

A. Condenser coil shall have aluminum microchannel plate fins mechanically bonded to seamless copper tubes.

1. Units having side inlets shall have coil guards.
2. Coil shall be circuited for sub-cooling.
3. Coils shall be burst and leak tested.
4. Liquid service valves.

B. Fans shall be direct driven propeller upflow type.

1. Fan motors shall have inherent overload protection, be permanently lubricated, and resiliently mounted.
2. Each fan shall have a safety guard.
3. Cycle fans or use solid state fan speed control for low ambient operation.
4. Static and dynamically balanced fans.

C. Units shall be operable down to 0°F outdoor temperature.

D. Compressors

1. Scroll compressors shall be designed with the following features
   a. Spring isolators.
   b. Crankcase heater.
   c Compressor motor overload protection.
   d. Suction gas-cooled hermetic motor.
   e. Service valves with Schraeder charging valves.
   f. Direct drive.
   g. Centrifugal oil pump.

2. Scroll compressor shall also have -
   a. Automatically reversible oil pump.
   b. Oil sight glass and charging valve.
   c. Oil pressure switch.

3. Condensing units 7½ tons or smaller shall have only one compressor. Condensing units larger than ten tons shall have two compressors minimum, each serving separate cooling circuit and coils.

E. Controls

1. Factory wired and located in separate enclosure.
2. Safety devices shall consist of high and low pressure cutouts, and internal or plug type relief valves.
3. Unit shall be complete with magnetic starters.
4. Unit shall have anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
5. Unit shall have controls to initiate a refrigerant pump down cycle at system shut down.

F. Casing

1. Fully weatherproof for outdoor installation. Finish shall be weather resistant.
2. Panels shall be removable for servicing.
3. Provide openings for power and refrigerant connections.
4. Provide coil hail guards.

G. Condensing units shall use R-410A refrigerant. Make one liquid line, one suction line, and one power connection to each unit for each compressor in condensing unit. Provide charging valves.

H. EER rating as defined by ARI shall be not less than 11.7.

I. Set units on neoprene type vibration isolation pads located at each corner, 4"x4"x3/4" minimum.

2.2 TWO TON THROUGH FIVE TON UNITS

A. Condenser coil shall have aluminum plate fins mechanically bonded to seamless copper or aluminum tubes.

1. Provide coil guard for unit.

B. Fans shall be direct driven propeller upflow type.

1. Fan motor shall be single or two speed, thermostatically controlled, permanently lubricated, and designed with permanent protection.
2. Motors shall be resiliently mounted.
3. Each fan shall have a safety guard.

C. Units shall be operable down to 20°F outdoor temperature.

D. Compressor shall be of hermetic design with the following features. Each condenser unit shall have only one compressor.

1. Externally mounted brass service valves with charging connections.
2. Crankcase heater.
3. Resilient rubber mounts.
4. Compressor motor overload protection.
5. Single speed

E. Controls

1. Factory wired and located in separate enclosure.
2. Safety devices shall consist of high and low pressure cutout and condenser fan motor overload devices.
3. Unit shall have anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.

F. Casing

1. Fully weatherproof for outdoor installation. Finish shall be weather resistant.
2. Openings shall be provided for power and refrigerant connections.
3. Panels shall be removable for servicing.

G. Expansion Valves

1. Stainless steel diaphragm and same refrigerant in thermostatic elements as in system. Externally or internally equalized as required by evaporator/condensing system.
2. Size valves to provide full rated capacity of cooling coil served.
3. Furnished by evaporator coil/condensing unit supplier and coordinated to provide bleed holes for system pressure equalization, if required.

H. Condensing units shall use R-401A refrigerant.

I. Only one liquid line, one suction line, and one power connection shall be made to each compressor. Provide charging valves.

J. EER rating as defined by ARI shall be not less than 13.0.

K. Set each unit on neoprene isolation pads located at each corner and sized 4" x 4" x 3/4" high minimum.

2.3 APPROVED MANUFACTURERS

A. Bryant

B. Carrier

C. Day & Night

D. Lennox

E. Payne

F. Trane

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set condensing units on concrete slab.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service

1. Condensing units shall be started up, checked out, and adjusted by Condensing Unit Manufacturer's authorized factory trained service mechanic.
2. Mechanic shall use check-out sheet provided by Manufacturer, complete and sign all items on sheet, and submit to Architect.

END OF SECTION 236213

SECTION 237218 - THROUGH-THE-WALL AIR CONDITIONING UNIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. Includes but not limited to

1. Furnishing and installing through-the-wall air conditioning units where shown on Drawings.

B. Be certain of proper voltage required when ordering equipment.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS AND MODELS

A. Trane PTEE 0701and accessory aluminum horizontal louver type grille.

PART 3 - EXECUTION

3.1 GENERAL

A. Exercise care in installing these units so they operate quietly.

B. Caulk around louver and install unit so no outside air leaks into room.

C. Thoroughly clean inside of unit.

D. Install nonflammable foam insulation in all wall voids.

END OF SECTION 237218

SECTION 237220 - MAKE-UP AIR UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

C. Section 234100 - Filters

1.2 SUMMARY

A. Includes but not limited to

1. Furnish and install make-up units as described in Contract Documents.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Make-up Air Units

1. Cabinets
   a. Constructed by galvanized steel with protective enamel on zinc coated finish, adequately braced and reinforced, and of sectionalized construction.
   b. Panels shall be removable for easy access to interior of unit.
   c. With interior mounted motors, hinged access doors with cam locks.
   d. Cabinet panels shall be internally insulated with 1” think, 3/4 lb density, vinyl coated glass fiber insulation.
   e. Seal joints with permanent type flexible mastic.

2. Provide insulated drain pan with condensate connections at each end. Extend drain pan under coil headers and refrigerant distributors. plus, unused ends.
3. Fans
   a. Double inlet, double width, forwardly curved centrifugal type designed for Class I operation.
   b. Base fan ratings on tests conducted in accordance with AMCA Code #210.
   c. Construct fan housings with streamline inlet and side sheets.
   d. Fans shall be statically and dynamically balanced and tested. Maximum rated fan RPMs shall be well below first critical fan shaft speed.

4. Fan Shaft - Solid high carbon steel.
5. Bearing
   a. Self-aligning, grade lubricated, ball type, and sized minimum service factor of 4.
   b. Provide lubrication fittings. Permanently lubricated bearings are not acceptable.
   c. Provide extended lubrication lines to accessible side of unit.

6. Rate V-belt drives at 150% of motor rating.
    a. Motor sheaves shall be of adjustable pitch type giving 30% speed variation.
    b. Fabricate belt guards from 16 gauge galvanized steel rigidly supported.
    c. Provide 1½" diameter tachometer holes for both fan and motor shafts.

7. Motors
    a. As described in Contract Documents and mounted on rubber isolated base incorporating a device for belt tightening, or internal to unit with fan, motor, and drive assembly internally isolated.

8. Burner & Heat Exchanger
    a. Heat Exchanger: 409 Stainless steel welded construction.
    b. Gas Burner: Atmospheric type with adjustable combustion air supply, combination gas valve and pressure regulator incorporate manual shut-off, automatic 100% shut-off and thermo-couple pilot safety device, and electronic pilot ignition.
    c. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.
    d. Duct Thermostat: Cycles burner to maintain discharge air temperature setting.
    e. High Limit Control: Fixed stop at maximum permissible setting, de-energized burner on high bonnet temperature and re-energizes when temperature drops to lower value.
    f. Duct Thermostat: Shall be low voltage, to control burner operation, heater modulates to maintain temperature setting.

9. Filter
    a. Provide with hinged access doors and quick release locking handles.
    b. Provide end fillers as necessary to prevent by-passing of air.
    c. Provide 1" wide 16 gauge galvanized steel filter removal strap with one end bent up 1" to form hook.

10. Approved Manufacturers
    a. Trane
    b. Modine
    c. Reznor
    d. Hastings
    e. Sterling
    f. Greenheck
    g. Econ Air
    h. Captive Aire

2.2 ACCESSORIES

A. Roof

1. Curb shall be fully welded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units on manufacture fully welded curbs.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service

1. Equipment Contractor to provide start-up service.

END OF SECTION 237220

SECTION 237310 - MODULAR PACKAGED AIR HANDLER EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. Section 230501 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. The units must be rigged, lifted, and installed in strict accordance with the Installation, Operation, and Maintenance manual. Unit performance is certified in accordance with ARI Standard 430 for Central Station Air Handling Units. Sound power levels are in accordance with AMCA 300-96 and ARI 260P. Joints between wall panels and structural frames are sealed with closed cell gasketing for leak seal, thermal and acoustical break.

1.3 EXTERNAL SUPPORT KIT

A. Units ship fully assembled (within freight limitations) on a galvanized steel external support kit/housekeeping pad.

1.4 UNIT CONSTRUCTION

A. Unit is constructed of a complete frame with removable panels. Removal of side panels shall not affect the structural integrity of each module. The casing is able to withstand up to 6" positive or 4" negative static pressure. All exterior wall panels are made of G90 galvanized steel. Closed-cell foam gasketing is provided where modules are joined.

B. Outdoor units exposed to the weather shall be weathertight to water, snow and ice penetration of all joints

1.5 ACCESS DOOR CONSTRUCTION

A. Full sized hinged removable double-wall access doors with two step safety handles are provided for quick access to the interior of the unit casing.

B. Exterior wall of door is made of G90 galvanized steel. Interior wall of door is 20-gauge solid galvanized steel.

C. Provide windows in each door.

1.6 PAINTING

A. Unit shall be painted with rust primer and 2 layers baked on finished coat to protect unit from weather.

PART 2 - PRODUCTS

2.1 ACCESS/INSPECTION/BLANK MODULE

A. Module provides additional access/inspection space for upstream/downstream components and/or provides space for field installed components.

B. Insulation

1. Module is double wall constructed to prevent fiberglass erosion into the air stream and allow cleaning of the unit interior. Interior wall is 22-gauge solid galvanized steel. Factory insulation is 4" thick 1½ lb density (R-16).
2. Insulation complies with NFPA-90A requirements for flame spread and smoke generation.

C. Access Door

1. Module has door on one side.

2.2 FILTER MIXING BOX MODULE

A. Mixing box module supports damper assembly for proper air flow. Module contains 4" angled side access filter rack.

B. Insulation

1. Module is double wall constructed to prevent fiberglass erosion into the air stream and allow cleaning of the unit interior. Interior wall is 22-gauge solid galvanized steel. Factory insulation is 4" thick 1½ lb density. (R-16).
2. Insulation complies with NFPA-90A requirements for flame spread and smoke generation.

C. Access Door

1. Module has door on one side.

D. Back Outside Air/Return Air Dampers

1. Outside air/Return air dampers are provided to modulate the volume of outside and return air. Dampers are of airfoil design and parallel blade type with metal compressible jamb seals and extruded vinyl blade edge seals on all blades. Blades rotate on stainless steel sleeve bearings. Maximum damper blade length is 60". Leakage rate not to exceed 5 cfm/ft² at 1" wg and 9 cfm/ft² at 4" wg.

E. Filters

1. Filters are of the throwaway type and have 4" thick fiberglass media contained in a rigid frame. Filters have a rigid supporting maze across both the entering and leaving faces of the media. Filters have average air resistance of 82% based on ASHRAE Standard 52.1, 1992. Filters are sized so as not to exceed scheduled face velocities.

2.3 COIL MODULE

A. Coil module is provided complete with coil and coil holding frame. Fins have collars drawn, belled, and firmly bonded to the tubes by means of mechanical expansion of the tubes. Coils are mounted in the unit casing to be accessible for service and can be removed from the unit either through the side or top. Capacities, pressure drops and selection procedures are certified in accordance with ARI Standard 410.

B. DX and Hot Water Coil

1. See DX and hot water coil Section 236514. A single-row serpentine coil, with ½" OD tubes, is enclosed in the coil section. Coil has a supply header to ensure distribution of chilled water to each tube of coil. Coil is proof tested at a minimum of 300 psig and leak tested to 200 psig, air pressure under water. Working pressure is 200 psig at 220°F.

C. Coil Supply Connection

1. Coil supply connection shall be field determined as to left or right side and bottom of supply fan.

D. Insulation

1. Module is double wall constructed to prevent fiberglass erosion into the air stream and allow cleaning of the unit interior. Interior wall is 22-gauge solid galvanized steel. Factory insulation is 4" thick 1½ lb density (R-16).
2. Insulation complies with NFPA-90A requirements for flame spread and smoke generation.

E. Drain Pan

1. Module has a sloped, insulated double wall galvanized drain pan under coil section for positive drainage of condensate. Drain connection is provided on one side of module.

2.4 EXHAUST/FRESH AIR DECK

A. Fan is double width, double inlet, and multi-blade type as manufactured by the unit manufacturer. Fan is backward inclined airfoil (AF) as required for stable operation and optimum energy efficiency. Fan performance is certified as complying with ARI Standard 430-89. Fans are dynamically balanced at the factory as a complete fan assembly (fan wheel, motor, drive, and belts). Fan shafts not to exceed 75% of their first critical speed at any cataloged rpm. Fans are equipped with L50-200,000 hrs. self-aligning, anti-friction bearings. See Section 15030 for VFD specification.

2.5 COLD/VENTILATION

A. Fan is double width, double inlet, multi-blade type as manufactured by the unit manufacturer. Fan is backward inclined airfoil (AF) as required for stable operation and optimum energy efficiency. Fan performance is certified as complying with ARI Standard 430-89. Fans are dynamically balanced at the factory as a complete fan assembly (fan wheel, motor, drive, and belts). Fan shafts not to exceed 75% of their first critical seed at any cataloged rpm. Fans are equipped with L50-200,000 hrs, self-aligning, anti-friction bearings.

B. 2” Spring Isolators

1. Fan and motor assembly is internally isolated from the unit casing with 2” deflection spring isolators, furnished and installed by the unit manufacturer. The isolation system is designed to resist loads produced by external forces such as earthquakes and conform to the current requirements for Seismic Zone IV.

C. Motor Frame

1. Motor is mounted integral to an isolated fan assembly furnished by the unit manufacturer. Motor is mounted inside the unit casing. Motor is mounted on a slide base to permit adjustment of drive belt tension. Motor is “T” frame squirrel cage NEMA Design B with size, type and electrical characteristics as shown on equipment schedule.

D. Motor Voltage

1. Motor is 208/60/3.

E. Drive Service Factor

1. Drive is constant speed with fixed pitch sheaves. Drive is selected at 1.5 service factor.

F. Motor Location

1. Motor/drive service location is on right side of module.

G. Insulation

1. Module is double wall constructed to prevent fiberglass erosion into the air stream and allow cleaning of the unit interior. Interior wall is 22-gauge solid galvanized steel. Factory insulation is 2" thick 1½ lb density.
2. Insulation complies with NFPA-90A requirements for flame spread and smoke generation.

H. Combination VFD/Disconnect w/Bypass

1. A combination Variable Frequency Drive/circuit breaker disconnect with three contactor bypass, is factory mounted, wired, and tested. Features include: LCD screen and keypad, 0-10VDC or 4-20mA speed input signal, and Pulse Width Modulation w/Intelligent Power Modules (IPMs). The voltage and FLA are factory set for the exact motor that ships in the air handler.

I. Angled Filter Module

1. Angled filter module contains an angled side access gasketed filter rack.
2. Filter Rack
   a. Filter rack accommodates 4" filters.

3. Filter Type
    a. Filters are 4" thick non-woven cotton fabric, treated with adhesive and continuously laminated to a supported steel wire grid. Filters have a rated average dust spot efficiency of not less than 25% to 30% when tested in accordance with ASHRAE 52-76 atmospheric dust spot method. Filters are sized so as not to exceed scheduled face velocities.

4. Insulation
    a. Module is double wall constructed to prevent fiberglass erosion into the air stream and allow cleaning of the unit interior. Interior wall is 22-gauge solid galvanized steel. Factory insulation is 2" thick 1½ lb density.
    b. Insulation complies with NFPA-90A requirements for flame spread and smoke generation.

5. Access Door
    a. Module has a door on one side.

2.6 MODULAR AIR HANDLER DESIGN CONDITIONS

A. See sheet M0.1 for air handler’s schedule.

2.7 PRODUCT

A. Approved Manufacturers

1. Venmar
2. Fan Wall
3. Temtrol

END OF SECTION 237310

SECTION 237313 – AIR HANDLER UNITS WITH COILS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 230501 - Basic Mechanical Materials and Methods sections apply to work of his section.

C. Section 234100 – Filters.

1.2 SUMMARY

A. Includes but not limited to:

1. Furnish and install air handling units as described in Contract Documents.

1.3 QUALITY ASSURANCE

A. Units with coils shall be ARI certified and bear certification symbol.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Cabinets

1. Constructed of heavy gauge steel with protective enamel on zinc coated finish, adequately braced and reinforced, and of sectionalized construction.
2. Panels shall be removable for easy access to interior of unit.
3. With interior mounted motors, hinged access doors with cam locks.
4. Cabinet panels shall be internally insulated with 1” thick, ¾ lb density, vinyl coated glass fiber insulation.
5. Seal joins with permanent type flexible mastic.

B. Provide insulated drain pan with condensate drain connections at each end. Extend drain pan under coil headers and refrigerant distributors. Plug unused ends.

C. Fans

1. Double inlet, double width, forwardly curved centrifugal type designed for Class I operation.
2. Base fan ratings on tests conducted in accordance with AMCA Code #210.
3. Construct fan housings with streamline inlet and side sheets.
4. Fans shall be statically and dynamically balanced and tested. Maximum rated fan RPM shall be well below first critical fan shaft speed.

D. Fan Shaft

1. Solid high carbon steel.

E. Bearings

1. Self-aligning, grease lubricated, ball type, and sized minimum service factor of 4.
2. Provide lubrication fittings. Permanently lubricated bearings are not acceptable.
3. Provide extended lubrication lines to accessible side of unit.

F. Rate V-belt drives at 150% of motor rating.

1. Motor sheaves shall be of adjustable pitch type giving 30% speed variation.
2. Fabricate belt guards from 16 gauge galvanized steel rigidly supported.
3. Provide 1½" diameter tachometer holes for both fan and motor shafts.

G. Motors

1. As described in Contract Documents a mounted external to fan-coil unit on rubber isolated base incorporating a device for belt tightening, or internal to unit with fan, motor, and drive assembly internally isolated.
2. Locate motor on side of unit most accessible in Mechanical Room.

H. Coils

1. Direct expansion type with plate type aluminum fins and copper tubes, ARI certified.
2. Arrange cooling coil vertically in coil section.
3. Completely enclose coil headers and refrigerant distributors in insulated casing with only connections extended through cabinet.
4. Liquid and suction connections shall be on same end of coil.
5. Circuit coils as shown or as required for capacity reduction.

I. Filter Boxes

1. Provide with hinged access doors and quick release locking handles.
2. Provide end fillers as necessary to prevent by-passing of air.
3. Provide 1" wide 16 gauge galvanized steel filter removal strap with one end bent up 1" to form hook. Lay strap in bottom of each filter support channel.

J. Approved Manufacturers

1. Airtherm
2. Bohn
3. Carrier 39E
4. McQuay
5. Trane Climate Changer
6. York

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units on spring type vibration isolators sized as recommended by Unit Manufacturer and so springs will not bottom out when unit is set on isolators.

END OF SECTION 237313

SECTION 260501 - COMMON ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 01 Specification sections, apply to work of this section.

B. This is Division 26 of the project specifications; this coupled with the drawings are to be used in the construction of this project. Each section recorded hereafter makes reference to the electrical systems, equipment, materials, connections, etc., and apply to all the work making reference and/or titled Electrical and/or Electrical Contract Documents.

C. Architectural, Structural, Fire Sprinkling, Plumbing, Mechanical and other applicable and related documents are considered a part of the electrical documents insofar as they apply as if referred to in full.

1.2 SCOPE OF WORK

A. The scope of this project is to construct a complete electrical system for the Payette School District Career Technical Education Building. Each area shall be developed electrically to give proper illumination, power utilization, auxiliary networks, etc. When the project is complete all systems integrate into a total electrical network making the building a usable facility.

B. The auxiliary systems: Sound Reinforcing, Intercommunication (includes class control) Tele/media System, Telephone, Fire Alarm, Television, Special Sound Systems, Data, Security etc., cover the entire indicated facility and must function as a unit to meet the needs of all occupants. Thence, the equipment supplier, the installer, and the constructor shall work toward that end. Anything short of this objective will not meet the intent of the project, i.e., each system shall be complete and effectively perform the function for which it was designed.

C. This project includes renovation and updating the electrical distribution system, i.e., consolidation of the multiple electric service to a single utility company provided transformer and reworking/expanding the existing electrical power distribution system.

D. Extent of electrical work is indicated on drawings and/or specified in Divisions 26-28 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items:

1. 260508 - Basic Electrical Materials and Methods
2. 260510 - Existing Facilities and Equipment
3. 260515 - Electric Service Connection
4. 260519 - Low Voltage Electrical Power Conductors and Cables
5. 260520 - Electrical Wiring Connections
6. 260526 - Grounding and Bonding
7. 260529 - Concrete Platforms and Bases
8. 260533 - Raceways for Electrical System
9. 260534 - Boxes, Pull Boxes, Conduit Bodies and Fittings
10. 260548 - Electrical Supports and Seismic Restraints
11. 260553 - Electrical Identification
12. 260923 - Lighting Control Devices

13. 262413 - Electrical Service and Distribution Switchboards
14. 262416 - Panelboards
15. 262726 - Wiring Devices
16. 262813 - Fuses
17. 262816 - Enclosed Switches and Circuit Breakers
18. 262910 - Overcurrent Protective Devices
19. 262913 - Enclosed Controllers and Starters
20. 264313 - Transient Voltage Suppression
21. 265100 - Interior Lighting
22. 265200 - Emergency Lighting
23. 265600 - Exterior Lighting
24. 270000 -280000 Data, Telephone, Audio, Video, Sound Systems, Clocks, Security Fire Alarm & Detection
25. 270500 - Telephone Conduit and Boxes
26. 271000 - Data Conduit and Boxes (Conduit Only)
27. 283123 - Fire Alarm System

E. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus, and systems required as a portion of this work.

F. Divisions 27 & 28 shall be bid with Division 26 as many of the conditions stated there in are found in Division 26. Namely, conduit, boxes, support, seismic bracing, etc. **Do not separate Division 26 from Divisions 27 & 28, they are all one contract.**

1.3 CONTRACT DOCUMENTS AND EXAMINATION OF THE SITE

A. Each bidder shall study the construction documents (plans and specifications), visit the site of the proposed work to fully acquaint himself with the conditions relating to the construction, so that he understands the difficulties and restrictions attending the execution of the work to be placed under contract. From all the above information, together with the cost of equipment, materials, labor, etc., the bidder shall then assemble and submit his cost to complete the project. The failure or omission of any bidder to receive or examine any contract documents, form, instrument, addendum or other document or to visit the site and acquaint their self with existing conditions shall in no way relieve any bidder from obligations with respect to his bid or to the contract. Written addendums (formally issued) become a part and parcel to the construction documents. The submission of a bid shall be taken as prima facie evidence of compliance with this section.

1.4 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

A. Any person contemplating submitting a bid shall familiarize himself with the drawings, specifications and project site. If for any reason, the bidder of the proposed contract, is in doubt as to the true meaning of any part of the drawings, specifications, or other contract documents, or finds discrepancies in, or omissions from, the drawings and specifications he shall submit a written request for an interpretation, correction and/or clarification to Architect/Engineer. The person submitting the request shall be responsible for its prompt delivery. **Any interpretation or correction of the contract documents prior to bid shall be made only by addenda duly issued**. An oral statement by anyone on any provision in the contract documents prior to the bidding is declared invalid.

B. After acceptance of the contract, the Contractor shall meet the intent, purpose and function of the contract documents and **no changes shall be made to the contract documents, except it be in writing and/or a drawing, over the signature of the engineer and/or his representative**. Any costs of materials, labor and equipment arising therefrom, shall be made

known to the owner's representative (Project Manager and/or the General Contractor) within 24 hours or the costs become the responsibility of the Contractor.

1.5 LAW AND REGULATION

A. The bidder's attention is directed to the fact of all applicable laws, ordinances and rules and regulations of all authorities having jurisdiction over construction of the project shall apply to contract throughout, and they shall be deemed to be included in the contract of the same as though here written out in full.

1.6 CONSTRUCTION OBSERVATIONS:

A. During the course of construction of this project, the engineer shall visit the project site periodically on an as-needed basis. The construction observation intervals may vary depending on the progress and/or stage of construction and to observe the electrical conduit rough-in above or below grade, setting of the main and branch panels, auxiliary units and panels, surface mounted items, setting of equipment, equipment connections, etc. However, written field questions are encouraged and welcomed throughout the course of construction and shall be answered promptly in writing, to keep the project construction on schedule. The project foreman should have the building plans, construction schedules, etc., affixed in mind, so the electrical systems being assembled, the setting of equipment, of parts and pieces, related to the project are anticipated, to prevent delays or emergencies.

B. The engineer shall make one (1) final inspection. The contractor shall notify the engineer that the installation is complete, i.e., the systems are operating and have been tested and balanced, and everything is complete and operational, all equipment connections have been made and the owner's representatives have been trained. At this time the engineer, the contractor, and the owner's representative shall schedule a time to walk the project for evaluation, and record in writing the items found to be incomplete. The contractor shall make the corrections within one (1) week after this inspection. If at the conclusion of the observation tour the owner and engineer determine that additional visits are required to complete the project, **the contractor shall reimburse the engineer at the rate of $800 for each site visit required, plus out of pocket expenses, until all items are acceptable to the engineer and owner. The contractor shall pay the engineer in advance of each inspection.**

C. Before scheduling an additional visit, the contractor shall report to the engineer that all systems are complete, and the project is ready for the owner's acceptance.

1.7 OFFICIAL, AGENT AND EMPLOYEES OF THE OWNER NOT PERSONALLY LIABLE

A. It is agreed, by and between the parties hereto that in no event shall any official, officer, employee, or agent of the Owner in any way be personally liable or responsible for any covenant or agreement herein contained whether expressed or implied, nor for any statement, representation or warranty made herein or in any connection with this agreement.

1.8 SUBLETTING AND SUBCONTRACTING

A. This Bidder is responsible for the construction stated or defined in this Contract and, as such, shall abide by the Subletting and Subcontracting Fair Practices Act as set forth and outlined in the General Conditions, Designation of Subcontractors.

1.9 CONTRACTOR COORDINATION

A. In the course of installing the systems defined in the contract documents, the contractor shall

closely follow the plans, details and specifications (contract documents). The system design has been a careful and laborious undertaking, with the intent purpose of producing a system and/or systems that will serve the owner well with minimum maintenance. The contractor shall adhere as close as possible to the plans, details, and specifications for each system. Questions and suggestions are encouraged as the project is being assembled. If for any reason, the contractor desires to deviate from the defined information, because he discovers a way to improve the system, make the system more easily assembled, make it operate more efficiently, etc., the contractor shall present the changes to the engineer. Systems are designed to perform a specific function; the smallest change in assembly may change the function. If the engineer agrees with the change he will authorize the contractor to proceed. Contractor cooperation and coordination is appreciated. If the contractor proceeds with construction without the designer's authorization, it shall be reworked, in accordance to plans and specifications, at the contractor's expense.

1.10 QUALITY ASSURANCE

A. Comply with the requirements of State and Local Ordinances. If a conflict occurs between these requirements and the contract documents, the most stringent requirements shall govern. The contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the contract documents which may be in excess of the aforementioned requirements, and not contrary to same.

B. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.

C. Employ only qualified craftsmen with at least three years of experience (in power equipment, conduit work, high voltage equipment, etc.). Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices (Media Standards of Installation). Provide a competent superintendent to direct the work at all times. Any person found incompetent by the General Contractor, Engineer, Architect, or Owner, shall be discharged from the project and replaced by satisfactory personnel.

D. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.11 MATERIALS AND WORKMANSHIP

A. All materials and equipment furnished and installed shall be first quality, new and meet the standards of NEMA, IPCEA, LS, UL, NFPA, UBC, OSHA, NEC, and shall bear their label wherever standards have been established and label service is available. Where materials and equipment are specified by manufacturer's name, the type and quality required is thereby denoted. The Architect shall be afforded every facility deemed necessary to inspect and examine the materials and apparatus being installed to prove the material quality and skill/competency of workmanship.

1.12 DEMOLITION, PATCH AND REPAIR

A. The Contractor is responsible for all block-outs, demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All repaired surfaces shall be finished (painted, etc.) to match the adjacent materials, finished and color.

B. When conduit passes through a ceiling and/or floor, block-out as required and/or core drill - do

not break out with a hammer of any type. The hole shall not be larger than ½" more than the diameter of the conduit.

C. When conduit is indicated to be installed below an existing concrete slab, cut the slab with a diamond saw and/or cutting tool. Do not just rip up the surface unless the entire section is removed.

D. When conduit is to be installed below asphalt, concrete, lawn, etc. the surface shall be cut, not ripped up, with a back-hoe or other equipment (i.e., mechanically cut then remove material).

E. Seal around all electrical equipment penetrating outside walls, roofs, unheated spaces, air plenums, cold boxes, etc., with Dow Corning Silicone RTV foam.

F. All salvageable electrical equipment and materials that cannot be integrated into the new electrical network become the property of the Contractor and shall be removed from the premise.

G. Hard Surfaces: whenever demolition or excavation is required for the installation of the electrical system, it is the responsibility of the Contractor to make repairs and/or replacement of hard finish surfaces such as concrete, asphalt, etc.

H. The method of patching and repair shall follow good construction practices. All finished surfaces shall match materials, and finish (surface texture and finish - paint, etc.) wherein the demolition occurred.

I. Lawn replacement resulting from excavation is to be included in the bid.

1.13 EXCAVATION, BACKFILL AND BORING

A. The Electrical Contractor is responsible for all excavation and backfill related to the installation for Division 26. All work shall comply with the conditions stated herein and those noted in the Architectural Section under Earthwork.

B. When conduit is indicated to be installed below an existing concrete slab, cut the slab with a diamond saw and/or cutting tool. Do not just rip up the surface unless the entire section is removed.

C. Backfill: The Contractor shall backfill the excavated areas with the material removed provided it does not contain rocks larger than 0.15” in diameter. If the excavated material is larger than indicated, the excavated area shall be filled with sand.

D. Backfill materials shall be put in place in 4” lifts and compacted to 98% of the maximum dry density of ASTM 698 over the entire area of the fill.

E. After the backfill is complete the finished surface shall match the adjacent surfaces, depth, quality finish, etc. (concrete, etc.).

F. Boring, or Auging - The contractor shall employ a firm skilled in installing underground utilities - piping, conduit, etc. for at least five (5) years, with care and concern the contractor shall drive the boring tool under the bleachers with care and concern. Any damage to the existing facility shall be repaired at the expense of the Boring Contractor. The installation shall follow and comply with the intent and details shown or the plans.

1.14 PROGRESS AND COORDINATION OF WORK

A. The electrical work shall be laid out in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Perform necessary cutting, drilling, or channeling with care. Use skilled mechanics of the trades involved and repair damage to building or equipment at no additional cost to the Owner. Cutting, drilling, or channeling through work performed by other trades shall only be done with the consent of the General Contractor. Cutting, drilling, or channeling through structural members shall only be done with the approval of the Architect.

B. Cooperate with other trades to coordinate locations of electrical outlets and apparatus.

C. Perform for other trades, the electrical wiring and connections for all devices or apparatus where not specified herein or indicated on the drawings. Consult the Architectural and Mechanical drawings to avoid hiding switches, outlets and other equipment behind doors, cabinets, counters, heating equipment, etc. Buried electrical devices and/or connections shall be relocated as directed by Engineer and/or authority having jurisdiction, at no additional cost to the Owner.

D. Where conduit, outlets or apparatus are to be cast in concrete or encased, it must be located and secured by a journeyman or foreman present at the point of installation. He shall check the locations of the electrical items before and after the concrete and masonry installation and shall relocate displaced items.

E. No changes shall be made in the design or location of apparatus unless specifically approved in writing.

1.15 COORDINATION WITH CEILING AND MECHANICAL SUBCONTRACTORS

A. Meet at least twice with the Ceiling Contractor. The first meeting shall accomplish coordination of all ceiling types with the specified light fixtures. The second meeting shall be held at the project site prior to installing the ceiling to coordinate the fixture layout in each area, and to determine if the depth will allow the installation of the fixture. If a conflict occurs with the layout or depth, the Engineer shall be contacted immediately so the conditions can be adjusted. A letter confirming the second meeting shall be sent to the Engineer with a copy to the Architect.

B. Meet at least once with the Mechanical Contractor prior to fabrication and installation of the ductwork to coordinate the depth and location of light fixtures and ductwork in all areas. All conflicts must be resolved before light fixtures are released for shipment. A letter confirming this meeting shall be sent to the Engineer with a copy to the Architect.

1.16 WIRING DIAGRAMS

A. As soon as possible after the contract to proceed is signed, one print of the control diagrams shown on the contract documents shall be developed (utilize the information on the contract documents) and Control Subcontractors, showing all necessary connections required for the equipment and devices proposed for installation. These prints shall be reviewed and approved by the Mechanical, Electrical, and Controls Subcontractor, and then submitted to the Architect/Engineer for approval. The prints shall indicate all components that are to be wired into the control power circuit by the Electrical Subcontractor, with all terminals for external connections of the components identified and labeled to correspond to the manufacturer's designations. Internal or factory installed wiring or package-type components need not be shown. The shop drawings for the Control System to be installed by the Controls Subcontractor shall be prepared as a separate and complete submittal and need not be entirely repeated on the

indicated prints except for the related electric connection. Color coding designations shall be indicated on the control power circuit wiring to be installed in the field by the Electrical Contractor.

B. Revised Drawings: After the Architect has approved the submitted copy of the control diagrams, the contract drawings will be revised, and the Contractor will be issued ten revised prints. The revised control diagrams shall be certified in writing as being acceptable to the Mechanical Design Engineer, Electrical Design Engineer, Mechanical Contractor, Electrical Contractor, and the Controls Contractor. The contract drawings will be revised by one of the two following procedures:

1. If the revisions to the controls diagram shown on the contract drawings are minor in the opinion of the Architect, the contract drawings will be revised and re-issued by and at the expense of the Architect.
2. If the revisions to the control diagrams shown on the contract drawings are ruled major in the opinion of the Architect/Engineer, the Prime Contractor shall prepare and submit a complete set of reproducible drawings of the control diagrams proposed for installation. These drawings shall be prepared on the same size sheets as the contract drawings and shall follow the same general format and quality of drafting as the contract drawings. After these reproducible drawings have been reviewed, approved and certified by the Architect/Engineer, the revised prints will be re-issued to the Contractor at the expense of the Design Engineers.

C. Changes During Construction: The complete responsibility and costs for changes to the approved control diagrams during construction and the resultant changes to the installation requirements not covered by contract change orders, shall be assigned to the respective section of these specifications under which the equipment is furnished.

1.17 SUBMITTALS OF EQUIPMENT FOR APPROVAL

A. SHOP DRAWINGS AND PRODUCT DATA BEING INSTALLED IN THE PROJECT: After the contract is awarded, but prior to manufacture or installation of any equipment, prepare complete Shop Drawings and Brochures for materials and equipment as required by each section of this specification. A brief submittal description of equipment that is approved for installation (bid documents or addendums), is given below. Refer to identified sections for detailed submittal requirements.

1 Main Service Disconnect and Distribution Switchboards (Section 262413)
2 Branch Panelboards (Section 262416)
3 Switches, Low Voltage Switching (Section 262726)
4 Motor and Circuit Disconnect Switches (Section 262816)
5 Overcurrent Protective Devices (Section 262910)
6 Motor Controllers and Starters (Section 262913)
7 Interior Building Light Fixtures, Ballasts, etc. (Section 265100)
8 Exterior Building Lighting (Section 265600)

This list is not all inclusive. The contractor shall submit product information for all items being installed on the project, contained in the drawings or elsewhere in this specification.

B. The electrical foreman, to acquaint himself with the project, is asked to review the shop drawings prior to submission to confirm size, voltages, loads, etc. **This cooperative effort** will prevent problems from occurring during the course of construction. Any problems that may arise shall be phoned to the engineer and noted in writing and submitted with the shop drawings.

C. Submit project information in electronic format per architectural submission requirements.

D. A minimum period of two weeks, exclusive of transmittal time, will be required each time a Shop Drawing and/or Brochure is submitted or resubmitted for review. This period shall be considered by the Contractor when scheduling submittal data.

E. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

F. Certifications shall be written or in the form of rubber stamp impressions as follows:

I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Signed _____

Position _____ Date _____

Observe the following rules when submitting Shop Drawings and Brochures.

1. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included, the submittal will be returned for re-submittal.
2. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Drafter skilled in this type of work. Shop Drawings shall be drawn to at least ¼"-1-0" scale.
3. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs which describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

1.18 OPERATION AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance data books for all equipment and materials furnished under this Division.

B. Submit operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or volumes and

identify the size, model, and features indicated for each item. Comply with architectural submission requirements.

C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete list of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified.)

D. Include the following information where applicable:

1. Identifying name and mark number.
2. Certified outline Drawings and Shop Drawings.
3. Parts list.
4. Performance curves and data.
5. Wiring diagrams.
6. Manufacturer's recommended operating and maintenance instructions.
7. Vendor's name and address for each item.

1.19 RECORD DRAWINGS

A. Maintain at the job site, on a daily basis, a complete set of "Record Drawings", reflecting an accurate dimensional record of all buried or concealed work. Mark "Record Drawings" to show the precise location of concealed work and equipment, including concealed or embedded conduit and junction boxes and all changes and deviations in the work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite authorization for such changes. The "Record Drawings" for daily recording shall consist of a set of blue line prints of the Contract Drawings.

B. Record dimensions clearly and accurately, delineating the work as installed; identify locations by at least two dimensions to permanent reference points.

C. Certify the "Record Drawings" for correctness by placing and signing the following certifications on the first sheet:

"CERTIFIED CORRECT (3/8" high letters)

By_____ Date_____
(Name of General Contractor)

By_____ Date_____
(Name of Electrical Contractor)

D. GUARANTEE: Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications and/or authorized changes. Without additional charge, replace any work or materials which develop defects, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

1.20 CLEAN-UP

A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.

B. Clean luminaires, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

1.21 POWER OUTAGE

A. All power outages required for execution of this work shall occur during non-standard working hours and/or at the convenience of the Owner. Include all costs or overtime work in the base bid.

B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.

C. Keep all outages to an absolute minimum.

1.22 STORAGE AND PROTECTION OF MATERIALS

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work under way, and apparatus against loss or damage.

1.23 CONCRETE PADS AND ASPHALT

A. The Electrical Contractor shall provide the concrete (5-bag mix) and/or asphalt except as noted in the contract documents. This may also include that which is needed to replace any and all removed through demolition. It shall match the existing as to type, quality, and thickness.

1.24 ELECTRICAL-MECHANICAL COORDINATION

A. General - All disconnect means, motor controllers, electrical controls, signal devices, etc., for mechanical equipment as noted in Division 23 & 24 of the specifications shall be furnished, installed, wired, and connected under Division 26. All pressure switches, thermostats, solenoid valves, damper motors, smoke duct detectors, etc. shall be supplied and installed under the Mechanical Division for electrical connection under this Division. Connection diagrams will be supplied as hereafter explained.

B. If the substitution of equipment in Division 23 results in a change to the contract documents and/or changes to the installation requirements (not covered by the contract change orders), then the Division 23 contractor shall reimburse the Division 26 contractor for additional work required.

C. If the substitution of equipment in Division 26 results in a change to the contract documents and/or changes to the installation requirements (not covered by the contract change orders), the complete responsibility for costs shall be assigned to the section of these specifications under which the equipment is furnished.

D. Provide all control conduit (See Section 260533-2.1-G(2)) with pull cord for mechanical system. No conduit is required through accessible spaces between VAV box and control transformers.

1.25 EQUIPMENT CONNECTION DIAGRAM

A. Submittal data for each individual electrically operated or electrically controlled item of equipment or device furnished under Division 23 & 24 and/or 26 of the contract documents shall include complete electrical wiring diagrams and elementary control diagrams (ladder form) showing all internal and external wiring connections and services. The submittal data shall itemize all electrical characteristics that are of a special nature or critical to the electrical installation or control system. Such equipment and devices will not be considered for approval until these requirements are met.

PART 2 - PRODUCTS

2.1 GENERAL

A. PRODUCTS are specified by Manufacturer name, description, and/or catalog number and shall be supplied as such.

B. DISCREPANCIES between equipment specified and the intended function of equipment shall be brought to the attention of the Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents, nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Engineer, who will issue interpretation and/or additional instructions to Bidders before the project is bid.

C. MANUFACTURERS AND SUBSTITUTE ITEMS: Provide products of manufacturers specified. Manufacturer's catalog numbers and descriptions establish the quality of product required.

D. Provide only equipment specified in the contract documents or approved by addendum.

2.2 LISTED EQUIPMENT

A. Provide and install materials, devices, appliances, equipment, etc. that conforms to applicable standards or is indicated to be acceptable by the established standards of the Underwriter’s laboratories, Inc., or other electrical product testing laboratories which are accredited by the department.

B. The statement in Item “A” above is being interpreted by the State Electrical Inspector as follows: It is understood that many specialty items such as power panels, light fixtures, devices and other building components are not available with a UL label covering the entire piece of equipment. The State will impose no requirement that an item of equipment be UL labeled unless it is available as a UL labeled item from at least two manufacturers. Electrical components of unlabeled equipment, such as motors, shall be labeled if they are available from at least two manufacturers.

C. If any building component is available with a UL label from at least two manufacturers, an identical or similar unlabeled component shall not be acceptable for installation. Should any such component be installed, it shall be replaced with a UL labeled component, before the building will be accepted by the Electrical Engineer.

D. Consequently, it shall be the sole responsibility of the Contractor (through project suppliers and equipment manufactures) to purchase and install only equipment bearing the UL label whenever the equipment so labeled is available. The Contractor (should any equipment be installed without the proper UL label) shall bear the entire cost of correction to the satisfaction of the authority having jurisdiction.

2.3 SUBSTITUTIONS AND SUBSTITUTE EQUIPMENT

A. Substitute equipment is encouraged if it is truly an equal to the specified items.

1. The designer has taken time and effort to analyze, evaluate and prove to himself that the specified unit will perform the function needed, wherein it is placed. This means the responsibility for the function of the specified equipment rests with the designer, who knows and understands what is to be accomplished.
2. If a **supplier** and/or the **contractor** desire to substitute equipment in place of specified item, he may do so, but he takes upon himself or herself the **full responsibility** that the substituted equipment will equal all of the performing characteristics, functions, etc., and/or exceed the performance of the specified item. The substitute equipment shall be of such a physical size and weight that it will mount in the designated location without alterations to the building and the structure will carry the load. If for any reason the substituted equipment requires alterations or modification, in any form to the building and/or the structure, the costs shall be paid by the contractor and/or those requesting the substitutions.
3. Those interested in requesting a substitution shall state the Manufacturer's catalog numbers and descriptions establish the quality of product required. **Substitutions will be considered if a written application is at the office of the Engineer eight (8) working days prior to day of bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.**
3. Because of the short bidding period, (from issuance of drawing to bid date), between the substitution request and the bid date, the designer does not have adequate time to make a full evaluation of substitute equipment. Therefore, **those requesting the substitution** must accept **full responsibility** for the items being submitted for substitution (operating characteristics, physical size, weight, output, not increase the load, etc.). If at any time during the course of construction, **even up into the final completion,** if the designer finds the equipment does not meet the design criteria, comply with the performance, etc., **those requesting the substitution and the contractor have the responsibility to remove the substituted equipment and install the specified item at their expense.** There shall be no cost assessed to the owner and/or the designer and **the replacement will not delay the completion of the project.**

B. **Discrepancies** between equipment specified and the intended function of equipment shall be brought to the attention of the Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents, nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specification, or should he find discrepancies therein, he shall bring this to the attention of the Engineer, who will issue interpretation and/or additional instruction to Bidders before the project is bid.

C. Any **conflict** arising from the use of **substituted equipment shall be the responsibility of the contractor,** who shall bear all costs required to make the equipment comply with the intent of the contract documents.

D. **Samples** may be required for non-standard or substituted items before installation during construction. Provide all samples as required.

E. **No materials or apparatus** may be substituted after the bid opening, except where the equipment specified has been discontinued. This substitution may be made by a change order.

F. Approved equipment shall be so noted, in writing in a formally issued **Project Addendum.**

2.4 INCENTIVE BIDS AND UNIT PRICES

A. Suppliers of materials, equipment, and systems are encouraged to submit incentive bids by grouping several products under one bid. However, at the request of the Architect and/or Engineer, the supplier shall submit a unit price to add or delete a particular unit, (panel, luminaire, fire alarm panel, etc.) from his quotation so that other components might be considered in the bid.

2.5 SPARE PARTS

A. Provide spare parts (fuses, overload heaters, diffusers, lamps, etc.) as specified. Transmit a list indicating all spare parts to Owner's Representative prior to substantial completion. Submit copy of transmittal letter to Engineer.

B. Fuses: Provide one spare set of fuses for each size and one spare set of each additional group of five (this includes fuses for bolted pressure and HV units).

C. Thermal Overloads: Provide one spare set of thermal overload heaters of each type used in the magnetic starters.

D. Auxiliary Systems: One (1) spare heat detector and three (3) smoke detectors shall be provided for the system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.

B. Since the drawings of floor, wall, and ceiling installation are made at small scale, outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.

C. Perform for other trades, the electrical wiring and connection for all devices, equipment, or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.

D. All electrical networks, power, auxiliary, etc., systems shall be installed in conduit; see Section

260533.

E. Where conduit, outlets or apparatus are to be embedded in concrete, they shall be located and secured at the defined point. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.

F. Provide block-outs, sleeves, demolition work, excavation, etc., required for installation of work specified in this Division. Opening shall be core drilled and/or saw cut and shall be no longer than required. Seal around conduit and on equipment inside and out with a silicone compound.

G. Roof Flashing: Where raceways penetrate roofing or similar area, provide 26 ga. galvanized iron roof jack, sized to fit tightly to raceway for weather tight seal, and with flange extending to a minimum of 9" under roofing on all sides. Coordinate all work with roofing contractor.

H. Patching and Repair

1. The Contractor is responsible for all block-outs, demolition, patching and repair of all finished interior and exterior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (textured, painted, etc.) to match the adjacent materials.
2. Hard Surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it should be the responsibility of the Contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, etc.
3. Lawn replacement is also included as a part of this section.
4. The method of patching and repair should follow good construction practices. All surfaces shall match materials and finish wherein the demolition occurred when construction is complete.

I. All electrically powered equipment specified on this project, whether specified in the architectural, mechanical, or electrical specification, shall be electrically connected and made operational. Confirm voltage, amperage, and phases.

3.2 COMPLETION OF WORK AND TESTING

A. Before energizing any circuits, make megger ground tests on conductors, bus duct and fused disconnects with the distribution breakers open. These readings shall be recorded by circuit number identification and submitted in triplicate to the Owner's Representative before the system is energized.

B. Before final inspection, but after the electrical installation is complete, the Electrical Contractor shall remove neutral grounded connection from main distribution panel and demonstrate to authority having jurisdiction and Owner's Representative, with an ohmmeter, that the electrical system neutral is grounded through main panel location only. Neutral shall be reconnected after the test is complete.

C. Emergency Power System: In the presence of the Owner's Representative, test the emergency power system, in its entirety, by transferring from normal to emergency power no less than six times to prove proper operation of all equipment, devices, light fixtures, etc. that are powered by this system. If a power pack is used, the factory representative should be present during the test. Write a letter to the Owner's Representative confirming the conditions of this test.

D. High potential tests per I.P.C.E.A., shall be made on all high voltage conductors after installation. A written report of same shall be made in duplicate to the Architect.

E. Test Equipotential grounding system throughout the building and report the results.

F. Auxiliary Systems - 27 & 28 Each system defined in Contract Documents shall be made operational by the factory representative. The Factory Representative shall confirm the operation of each component (speaker, stand by power, etc.) and report in writing (triplicate) his confirmation of the systems status of operation.

3.3 FINAL REVIEW

A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

3.4 PROJECT FINALIZATION AND START-UP

A. Upon completion of equipment and system installation, notify equipment Factory Representative and Subcontractors for system start-up.

B. Each Factory Representative and Subcontractor shall assist in start-up to examine their respective system and remain at the site until the total system operation is accepted by the Owner's Representative.

C. The Factory Representative and/or System Subcontractor shall give personal instruction on operation and maintenance of their equipment to the Owner's maintenance and/or operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:

1. This is to certify that the Factory Representative and/or System Subcontractor for each of the systems installed below have performed start-up and final check out of their respective systems is satisfactory.

D. System Operating Report: After the facility has been in operation for 10 days, submit with a letter of guarantee a triplicate record of a voltage reading and ammeter reading on each phase of the feeder for the main and all branch panels, motors, outside lighting, etc. to the facility (these readings shall be taken with all equipment operating). A second report shall be made on equipment that has a load over 20 Amp 1-pole in the mechanical room, kitchen, shops, etc. when in operation.

1. This dated system operating report shall be submitted to the Owner’s representative for distribution to the engineer and a copy placed in each maintenance manual.
   a. Electrical Load Readings:

Demand_____kw	Panel D_____Amp
Panel A _____Amp	Panel E_____Amp
Panel B _____Amp	Panel F_____Amp
Panel C _____Amp	

   etc. identify and record the load on each panel and motor loads ¾ hp and larger.

2. If there are any abnormal conditions, they shall be brought to the attention of the Engineer in writing as a part of this submittal.
3. Submit with the load readings for the motors, a list of motors with the size of overload heaters used for each motor. This includes thermal switches.
4. As a part of this document, submit a copy of each Auxiliary Systems test reports (Telephone, Fire Alarm, Sound, Data, etc.) with the proper signatures (See 3.2F).

System	Factory Representative

(List Systems Included) (List name and address of Factory Representative)

5. The Owner’s Representative has received complete and thorough instruction in the operation and maintenance of each system (See 3.4C).

_____ _____

Owner's Representative Contractor or Electrical Foreman

6. Report that each emergency luminaire has proven operational by opening the circuit overcurrent protection device and visually confirming the luminaire illuminates (See 3.2C).
7. The Owner’s Representative has received and accepted all spare parts as heretofore required by contact (See 2.5).
8. Submit meggar OHM, equippotential, and high potential test reports (See 3.2A, 3.2D, 3.2E).
9. Send copy of acceptance to Architect/Engineer.

END OF SECTION 260501

SECTION 260508 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 MATERIALS AND METHODS

A. Materials and methods common to this project are listed below and shall be followed as closely as practicable using acceptable construction practices and specified products. This section indicates conditions and practices that should become a part of this project.

1. Materials: The materials installed on this project shall be new, noted in this specification and shall be installed in the course of construction, except, they be changed in writing over the signature of the designer.
2. Method: The method of installation shall follow current acceptable electrical practices under the direction of a licensed journeyman electrician. This will be further explained in the body of the specification.
3. Notes: The notes on the plans are a part of the contract documents; a conflict between the specification and the drawings, the specifications rule.

1.2 EQUIPMENT CONNECTIONS

A. The Contractor shall install an electric service to the subject project as shown on the plans and described herein.

B. Extent of electrical connection for equipment includes final electrical connection of all equipment (supplied under this or any other division or by the owner) having electrical requirements. Make final connections for all owner furnished equipment. See other applicable Divisions of specification for building requirements, namely, mechanical, plumbing, temperature control wiring requirements, kitchen equipment, etc.

C. Refer to Division-23 sections for motor starters and controls furnished integrally with equipment.

D. Refer to Division-23 section for control system wiring; not work of this section, except as noted on the electrical plans.

E. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE

A. CODE COMPLIANCE: Comply with applicable portions of NEC, state, and local codes as to type products used and installation of electrical power connections.

B. UL LABELS: Provide electrical connection products and materials which have been UL-listed and labeled.

PART 2 - PRODUCTS

2.1 GENERAL

A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to; raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. See Section 260533, Conduit Raceways; Section 262726, Wiring Devices; and Section 260519 Conductors and Cables for additional requirements. Provide final connections for equipment consistent with the following:

1. Permanently installed fixed equipment - flexible seal-tight conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.
2. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).
3. Other methods as required by National Electrical Code and/or as required by special equipment of field conditions.

END OF SECTION 260508

SECTION 260510 - EXISTING FACILITIES AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Existing facility, whether standing alone or an addition to a standalone, or if the existing building is a part of a new facility, the bidder shall consider the existing unit a part of this project. All electrical equipment, panels, apparatus, luminaires, conduit/conductors, boxes, devices, etc., are to be removed, reworked, added to, extended, etc., as noted on the contract documents to make a complete and operable facility. The contractor shall also include in his bid an allowance to cover items that may be concealed in wall, ceiling, or floor, that must be rerouted, relocated, etc., to maintain or extend existing systems to keep them operable.

B. When the project is completed all systems, apparatus, etc., shall be made operable and left in normal operating order.

1.2 EXISTING EQUIPMENT

A. General: The electrical conditions in the existing facility are part of this project, and all costs, changes, extensions, additions, etc., pertaining thereto shall be included in the base bid.

B. Disconnect all equipment that obstructs and/or is to be relocated. Reconnect when reset.

C. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply unless otherwise specified.

D. The new luminaires indicated for existing outlets shall be installed in accordance with the luminaire specifications. New Conductors shall be installed from the panel to each existing outlet.

E. Conduit and wire installed in existing structures shall be concealed. Exceptions shall be an approval of Architect. (See demolition and patching sections).

F. When conduit is to be installed below concrete, etc., the surface shall be cut, not excavated with a backhoe or other equipment, but shall be mechanically cut then removed.

G. All electrical equipment and apparatus in the building not remodeled shall be connected as per specifications and left in working conditions.

H. Existing raceways shall be used where in good condition and suitable for the intended purpose, unless noted otherwise.

I. New conductors shall be installed throughout the project. This includes main and branch feeders and all branch circuit wiring in remodeled areas where changes and/or additions are being made.

J. All vacated or unused power, communication, signal, control wiring or cabling, etc., shall have wire pulled out of conduit back to branch panel or the first active outlet. The conductors/cabling become the property of the contractor and shall be removed from the site.

K. Any and all equipment having electrical systems (power, auxiliary, etc.) That require disconnecting and reconnection, at the same or another location throughout the course of construction, shall be included as part of this contract.

END OF SECTION 26 0510

SECTION 260515- ELECTRIC SERVICE CONNECTION

PART 1 - GENERAL

1.1 ELECTRICAL SERVICE SYSTEM

A. Provide, install, and coordinate an electric service to the facility as shown on the drawings and specified herein.

B. The Contractor shall contact Idaho Power Company relative to the installation of this electric service. **The owner will pay directly to Idaho Power Company any assessed costs to provide electric service.** The electrician shall install service conduit from utility service point to transformer and from transformer to meter. Provide and install transformer pad, meter section vault, install meter section, (EUSERC, if required), etc. as per Power Company specifications. Confirm the location of the point of service prior to rough-in.

C. The service conduit shall be installed as stated in the contract document, confirm size with the serving utility.

D. Provide and install the service metering equipment, shown on the plans and/or required by the serving utility, and/or as specified in the contract documents.

E. Construction Lighting and Power is a part of the General Conditions.

F. Permanent power shall be connected as soon as the main service and panel are installed.

G. Service feeders installed in PVC and/or RMC (see Section 260533) shall be shrouded with Red 5-bags concrete 3" minimum cover with #3 rebar at all corners.

H. Phase Rotation: When the permanent service has been established, the contractor shall check the rotation of all motors and confirm proper rotation. Each motor shall have a correct rotation. Any costs arising from a reversed motor shall be the Electrical Contractors.

1.2 SERVICE CONNECTIONS

A. Provide and install the lugs, cable, labor, etc. necessary for the connection of the service power and/or transformers for the project.

1.3 MAKING ELECTRICAL CONNECTIONS

A. Make electrical connections to all equipment provided under Divisions 21, 22, 23, 26, 27 and/or 28, as it was shown on either the mechanical or electrical plans. The connection shall be in accordance with connector manufacturer's written instructions and with recognized industry practices and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that product fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.

C. Coordinate installation of electrical connections for equipment with equipment installation work.

D. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings in writing to Architect before proceeding with rough-in work.

E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.

F. Confirm the rotation of all electric motors when making the final connection. Motors running in the reverse direction are the responsibility of this contractor.

G. Refer to basic materials and methods Section 260519, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 260515

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors (600V)

C. Applications for conductors and cables required for project include:

1. Feeders
2. Branch Circuits

1.2 QUALITY ASSURANCE

A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables which have been UL-listed and labeled.

B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.

C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

D. Non-approved materials.

1. AFC Cabling
2. Non-metallic sheathed cable.
3. Service entrance cable.

1.3 SUBMITTALS

A. FIELD TEST DATA: Submit test data in accordance with IEEE Standard 400-1980 showing ambient conditions, voltage levels, level durations, and conduction current for each step. Include effective insulation resistance in submittal.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS (600V)

A. All conductors shall be copper with 90% conductivity.

B. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide.

C. Proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:

1. Distribution and Panelboard Feeders; and other conductors, #2 AWG and larger shall be Copper; see drawings for size.
2. Conductors: All conductors shall be jacketed with THHN or XHHW insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide stranded conductors for #10 AWG and larger. Provide THHN insulated conductors (in dry areas) from outlets to luminaire, and in luminaire channels.
3. Conductor ampacity shall comply when local codes have a derating factor because of ambient temperature.
4. Provide color and coding of conductors as follows:
   a. Conductors
      1) All conductors shall be stranded copper wire, #12 AWG & #14 AWG may be solid copper. Color code all 208 volt wiring using black for phase A, red for phase B, blue for phase C, white for neutral and green for equipment ground.
      2) Color code all 480 volt brown for phase A, orange (purple) for phase B, yellow for phase C, gray for neutral, and green for equipment ground. A green ground shall be pulled in every conduit - see Grounding.
   b. Motor Control

1)	Motor Feeders	Black
2)	Hot or Stop Lead	Red
3)	Start Lead	Blue
4)	Common	White
5)	Indicating Light	Orange
6)	Interlock or Shunt	Brown
7)	Ground	Green

5. Identify conductors on premise per NEC 210.5.

2.2 AUXILIARY CABLES

A. The contractor shall provide and install a cable from each auxiliary system as noted below (before ordering this cable, check the specific auxiliary system 270000-280000 for exact cables). The cables shall be as noted in the specification for each specific system.

2.3 CONNECTING BLOCKS (Also see Section 260520)

A. Taps made to conductors in wireways, switchgear, J-Boxes, etc. larger than #10 shall be made with an insulated connector. The connector block shall be an alloy that is completely compatible with copper, aluminum alloy 6061-T6 conductive plating for low contact resistance, excellent anti-pull out ability and set-screw for suring in place. The block shall be insulated with a molded high dielectric plastisol that will not support combustion, abrasive and chemical resistant. All connections shall comply with rated for 600 volt 90º C and comply with NEC 100. Torque each lug to the recommendations of the manufacturer.

B. The unit shall be NSI Series NSZ (in and out same side), other types are: Series IPL (double row), Series IT (in and out), Series IPLD (pass through), etc. The contractor shall decide which type of connection is best suited for installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide #12 AWG conductors for all LED luminaire home runs.

B. Conductor size noted in panels is for the home run. The conductor may be changed to code size after the first apparatus.

C. Parking Lot line, neutral, and grounding conductors shall be installed of the size noted until a change is indicated. Minimum size #10.

3.2 GENERAL: Install electrical conductors and cables as indicated, in compliance with manufacturer`s written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.

A. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.

B. Use pulling compound or lubricant, where necessary; compounds must not deteriorate conductor or insulation.

C. Keep conductor splices to minimum in a J-box.

D. Install splices and taps which have mechanical strength and insulation rating equivalent-or-better than conductor.

E. Use splice and tap connectors which are compatible with conductor material.

F. The conductor ends shall be stripped at the ends to comply with the following chart:

1. Strip Length Chart

CONNECTOR SIZE	LENGTH (inches)
500	2
350	1.75
250	1.625
3/0	1.437
1/0	1.25
#4	0.875

2. All conductor connections on lugs, breakers, connection blocks, etc. of the set-screw type shall be set with a torque wrench in strict accordance with industry standards as recommended for each conductor size.

3. Lug Torque Chart

CONN SIZE	500	350	250	3/0	1/0	#4
AWG/MCM WIRE SIZE	TIGHTENING TORQUE, INCH POUNDS					
500	375					
400	325					
350	325	325				
250	325	325	325			
4/0	325	325	325			
3/0	250	250	250	250		
2/0	180	180	180	180		
1/0	180	180	180	180	180	
3-2-1	150	150	150	150	150	
#4 - #6	110	110	110	110	110	45
#8	75	75	75	75	75	40
#10 - #16	75	75	75	75	75	35

G. **Vertical Support:** Conductors rising vertically shall be supported with conduit kellems grips or equal, in accordance with NEC section 300-19.

Cable Vertical Support Spacing	
Conductor Size	Minimum Distance - Feet
12 - 1/0	100
2/0 - 4/0	80
4/0 - 350 KCM	50
500 KCM	40

3.3 FIELD QUALITY CONTROL

A. Prior to energization, test cable and wire for continuity of circuitry, and also for short circuits. Correct malfunctions when detected.

B. Check and prove the proper phase rotation of all rotating equipment powered by this network.

C. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements. (SEE SECTION ON COMPLETION AND TESTING)

END OF SECTION 260519

PART 1 - GENERAL

The contractor shall make all electrical connections relating to the power, lighting, and auxiliary systems for this project. Each connection shall be made in such a manner that it will not generate heat and destroy the connecting and/or the insulation on the conductor. All connections shall be made in a skilled craftsman like manner.

1.1 DESCRIPTION OF WORK (STANDARD CONNECTIONS)

A. All connections shall be in compliance with the 75° NEC ratings.

B. The conductors being connected shall be cut of sufficient length to conveniently make a splice - minimum 6”.

C. Conductors No. 8 and smaller can be connected with a spring wire connector after the conductors have been mechanically twisted two (2) turns.

D. Conductors No. 6 and larger shall be connected with pressure type terminal lugs of a type hereafter noted.

E. All connections made shall be set in compliance with the lug torque chart in Section 260519.

F. All conductor connections No. 8 and smaller made below a point 24" above grade outside the building shall be made with a non-hardening sealant connector.

G. All conductor connections No. 6 and larger shall be made with water tight connectors.

1.2 PRODUCT DATA

A. Conductors No. 8 and Smaller: Free spring wire connectors made from flame retardant thermo plastic rated at 105°C (221°F), UL Standard 486, CSA LR6541. Cu/Cy, 600V Intgr. TSB, NSI.

B. Conductors No. 8 and smaller outside building (ground j-box, pole base, etc.) water tight steel spring connectors with water-proof non-hardening sealant, same rating as “A”.

C. Conductors No. 8 and Larger (dry locations): Insulated copper rated connectors with Allen wrench set-screw, such as NSI “IT” Series (size to conductors).

D. Multiple conductor connections No. 8 and Larger (dry locations: NSI Series IPL, IPLD, etc.

E. Insulated terminal strips up to 30 Amp, 600V shall be a double terminal block such as NSI Series “TB”, with appropriate mounting hardware.

F. Terminal blocks (size to conductors) such as Square “D” No. CBA363106.

PART 2 - EXECUTION:

2.1 GENERAL

A. All connectors shall be secure in place making a tight electrical connection.

2.2 FIXED EQUIPMENT

A. Terminal strips, terminal blocks shall be firmly secured in place.

END OF SECTION 260520

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide grounding as specified by NEC, as noted herein, and as indicated on drawings. Types of grounding in this section include the following:

1. Underground metal water piping
2. Grounding electrodes
3. Separately derived systems
4. Concrete encased electrode (UFER)
5. Service equipment
6. Enclosures
7. Systems
8. Equipment
9. Isolated ground conductors
10. Other items indicated on drawings.

B. "G" in the conduit symbol denotes a green ground (to match indicated conductor sizes) which shall be installed in the conduit with other conductors. It shall connect to an insulated ground bar in the panel. (Exception: Main Panel terminations made on ground bar bonded to enclosure).

C. “G” in all conduit, apparatus, equipment, etc. outside the building denotes a #10 bare ground interconnecting all outside equipment having an electrical connection.

D. A green ground conductor shall be installed in all non-metallic conduit runs.

E. Install isolated ground conductors as indicated on the plans.

F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.2 QUALITY ASSURANCE

A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products which have been UL listed and labeled.

1.3 SUBMITTALS

A. None required.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation.

B. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

C. Install an insulated ground bar in branch panels.

2.2 ELECTRICAL GROUNDING CONDUCTORS

A. Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.

B. When conductor sizes are increased due to voltage drop (i.e., distance) the ground size shall be increased proportionately in size per NEC.

2.3 GROUND RODS

A. GROUND RODS: Steel with copper welded exterior, 5/8" dia. x 8’ (quantity as per Code).

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS

A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding devices comply with requirements.

B. Install braided type bonding jumpers with ground clamps on water meter piping to electrically bypass water meter.

C. Install clamp-on connectors only. Thoroughly clean metallic contact surfaces, to ensure electrical conductivity and circuit integrity.

D. Provide grounding for the entire raceway, enclosure, equipment, and device system in accordance with NEC. All non-metallic raceways shall include copper grounding conductor sized in accordance with NEC.

E. Provide a continuous service entrance ground conductor that interconnects the major ground points, namely ground rods (quantity of two, driven exterior to building), by means of bonding to water main, and by means of bonding (**Cad-Weld**) to building structural steel. If the conductor is not continuous each joint shall be **Cad-Welded**. The **Cad-Weld** constitutes a continuous conductor.

F. In addition to all cold water and ground rods provided to meet this specification, each location grounded to water main, or ground rod shall have a Concrete Encased Electrode (UFER) ground. A Concrete Encased Electrode (UFER) ground shall consist of a minimum of 20’ of No. 4 AWG bare copper cable (or per local code) embedded in concrete (feeder encasement, footing, floor slab, etc.) so that all portions of the cable are between 2" and 4" from the earth and with the center of the cable bonded to the ground rod or pipe.

G. Provide grounding conductors for dimming systems in accordance with manufacturer`s requirement.

H. All luminaire poles shall be grounded with a No. 10 stranded green ground.

I. See drawings for additional grounding requirements.

END OF SECTION 260526

SECTION 260529 - CONCRETE PLATFORMS AND BASES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section relates to providing and installing concrete supports, bases, etc., as indicated for the service needed for the power conduits, panel bases, pole bases, service transformer pad, etc. as an electrical equipment.

B. All code conditions related here to shall be enforced.

C. Buried conducts shall be shrouded with “red” concrete and shall be placed on virgin and compacted fill to prevent settling. Conduit shall be grounded to allow conduit to drain to a low point. If the low point is at a vertical elbow drill a ½” (0.5”) diameter hole at the low point in the elbow to drain all water. At that point provide a 12x12x12 gravel bed to receive the water

D. When stated install encase service conduit in a red 5-bag mix concrete. The concrete shall shroud the conduit a minimum of 2” on all sides. Depth of conduit shall be 48" or as per code.

E. All service feeders shall be located by placing a plastic **High Voltage Ribbon** in the fill, 12” above (or as per code) the conduit run, for location at future excavation.

F. Provide and install concrete bases as noted on the planes.

1. Concrete bases below panels shall be of the size noted on the plans, to raise the panel off the floor to eliminate water problems. The concrete shall be 5-bag mix with a finished to match the floor.
2. All concrete bases (light poles, bollards, etc.) shall be of a type and size to carry the load installed thereon. The concrete shall be 5-bag mix with rebar as indicated. The base shall have a smooth hand rub sand finish.

1.2 EXECUTION

A. The installation of each system and/or parts and pieces shall follow good journeyman practices and code conditions.

END OF SECTION 260529

SECTION 260533 - CONDUIT RACEWAYS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of raceway work is indicated by drawings and schedules.

B. Types of raceways in this section include the following:

1. Electrical Metallic Tubing (EMT).
2. Flexible Metal Conduit.
3. Intermediate Metal Conduit (IMC).
4. Liquid-Tight Flexible Metal Conduit.
5. Rigid Metal Conduit (RMC).
6. Rigid Non-Metallic Conduit. (below grade only w/RMC elbows)

C. Prohibited Raceway Materials:

1. Aluminum Conduit.
2. Electrical Non-Metallic Tubing (ENT).
3. Armored Cable Type AC (BX) Cable.

D. Prohibited Fitting Materials:

1. Crimp-on, Tap-on, Indenter Type Fittings.
2. Cast Set-Screw Fittings for EMT.
3. Spray (aerosol) PVC Cement.

1.2 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. Standards: Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.

C. Minimums: Minimum, conduit sizes shall be as per NEC Tables 3A, 3B, and 3C or as shown on plans. Minimum home run size shall be ¾". Electrical contractor shall not modify the wiring arrangement without prior approval from Engineer.

1.3 SUBMITTALS

A. Not required.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. General: Provide metal conduit, tubing and fittings or types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of ¾".

B. **Data/telephone conduit shall be installed as shown with 1¼" being the minimum size.**

C. Electrical Metallic Tubing (EMT): FS WW-C-563 and ANSI C80.3.

1. EMT Fittings: Provide and install set-screw type malleable steel fittings: connectors shall be insulated throat type, concrete tight where required by application. Install OZ Type B bushings on conduits 1¼" and larger.
2. Provide red EMT for fire alarm system (Allied "Fire Alarm E-Z Pull" or equivalent).
3. Provide blue EMT for data voice, video, and Security System (Allied "Blue EMT E-Z Pull" or equivalent).

D. Flexible Metal Conduit: FS WW-C-566, of the following type:

1. Zinc-coated steel.
2. Flexible Metal Conduit Fittings: FS W-F-406, Type 1 Class 1, and Style A.

E. Intermediate Metal Conduit (IMC): RS 22-C-581.

1. Intermediate Steel Conduit Fittings: Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at conduit terminations, use OZ Type B bushing on conduits 1¼" and larger.

F. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible, continuous interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC). Type UA and/or NMLT-B non-metallic.

1. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G and/or fittings to match the specified non-metallic conduit noted above.

G. Rigid Metal Conduit (RMC): FS WW-C-0581 and ANSI C80.1.

1. Rigid Steel Conduit Fittings: Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible, continuous interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC). Type UA and/or NMLT-B non-metallic.

H. PVC Externally Coated Rigid Steel Conduit: ANSI C08.1 and NEMA Std. Pub. No. RN1.

1. PVC Externally Coated Rigid Steel Conduit Fittings: Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible, continuous interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC). Type UA and/or NMLT-B non-metallic.

I. Expansion Fitting: OZ Type AX, or equivalent of suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS (Below grade only)

A. General: Provide non-metallic conduit, ducts, and fittings of types, sizes and weights (wall thicknesses) as indicated shall not be installed inside the building, except it be encased in concrete and surfaces through a RMC elbow; with minimum trade size of ¾ ". In this specification, it is not permitted above grade for any reason.

B. Underground PVC Plastic Utilities Duct: ANSI/NEMA TC 6, Type 1 for encased burial in concrete, Type II for direct burial.

1. PVC and Abs Plastic Utilities Duct Fittings: ANSI/NEMA TC9, match to duct type and material.
2. Conduit, Tubing, and Duct Accessories: Provide conduit, tubing and duct accessories of types, sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

C. Sealing Bushings: Provide OZ Type FSK, or FSKA.

D. Special Ground: To maintain the building ground continuity, a NEC size ground shall be installed in each non-metallic conduit run, where the system voltage is greater than 48-volts.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA "Standard of Installation", and in accordance with the following.

B. Feeders Under 600 Volts: Install feeders to panels, motor control centers and individual equipment feeders rated 100 amps and greater, in rigid metal conduit (RMC), or intermediate metal conduit (IMC). Where buried below grade, install in non-metallic conduit or duct. Feeder conduits 1½" round and larger shall be encased in concrete as a part of the floor. Do not install conduit up in the floor. Install conduit just below the floor with the top of the conduit touching the bottom of the slab and the bottom of the conduit being covered with at least 1" of concrete.

C. Outside feeders below grade shall be installed in RMC and/or PVC conduit shrouded with a minimum of 3" cover of red concrete with a #3 rebar in opposite corners. The top of the duct bank shall be set 48” below finish grade.

D. Branch Circuits, Signal and Control Circuits, and Individual Equipment Circuits Rated Less Than 100 Amps: Install in electric metallic tubing (EMT); except in poured walls, floor slabs, below concrete slab-on-grade, or in earth fill. Conduits installed in before mentioned areas shall be non-metallic plastic duct. Encase non-metallic plastic duct 1¼" and larger in concrete.

E. Coordinate with other work, including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

F. **When non-metallic conduit is used, it shall come to the surface in a RMC elbow or box.**

G. Install raceway in accordance with the following:

1. Provide a minimum of 12" clearance from flues, steam, and hot water piping, etc.

2. Conceal raceways in finished walls, ceilings, and floors (other than slab-on-grade). Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines.
3. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway.
4. **Flexible raceways shall not be concealed in construction and where installed the run shall be limited to 4' in length.**
5. Comply with NEC requirements for installation of pull boxes in long runs.
6. All raceways (metallic and non-metallic) shall terminate in a connection and/or bushing.

H. Division 23 shall install control conduit for Division 23 equipment.

I. Install fire alarm cable/conductors above grade in red fire alarm conduit (See 2.1-C (2). Avoid installation across open ceiling space when possible.

J. Install data, voice, video, and security cables above grade in blue conduit (See 2.1-C (3). Avoid installation across open ceiling space when possible.

3.2 NORMAL INSTALLATIONS

A. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandril and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.

B. Replace all crushed, wrinkled, or deformed raceway before installing conductors.

C. Provide rigid metal conduit (RMC) for all bends in buried conduit greater than 30º. Provide a protective coating for RMC bend as specified herein.

D. Where raceways penetrate building or vault walls and floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10' on the exterior side of the floor or wall. Provide OZ, Type FSK or WSK sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering building or vaults below grade.

E. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.

F. Install five spare ¾" conduit (capped) from each flush branch panelboard into accessible ceiling and floor space. Where the floor is not accessible run six conduits into accessible ceiling space. Run conduits the required distance necessary to reach accessible ceiling space.

G. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.

H. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.

I. All conduit that penetrates the roof shall be flashed with a factory jack, see Section 260501/1.3.

3.3 GROUNDING

A. All metal conduit terminations shall be equipped with a grounding bushing.

B. To maintain the continuity of the building ground network, install a code size ground conductor in all non-metallic conduit.

3.4 FIRE PENETRATION SEALS

A. All penetrations through fire rated floors and walls shall be sealed to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after the fire. The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. The sealant shall remain soft and pliable to allow for the removal and/or addition of cables without the necessity of drilling holes. It shall adhere to itself to allow any and all repairs to be made with the same material. It shall permit the vibration, expansion and/or contraction of raceways and/or cables going through the penetration without the seal cracking or crumbling.

B. When damming materials are to be left in place after the seal is complete, all such materials shall be non-flammable.

C. When sealant is injected into a penetration, the foam shall expand to surround all items within the penetration and maintain pressure against the walls of the penetration. The foam shall cure within five minutes and be fire resistant at that time. No heat shall be required to further expand the foam to block the passage of fire and smoke or water.

D. All wall or floor penetration opening shall be as small as possible.

E. The foam sealant shall meet all of the fire test and hose stream test requirements of ASTM E119-73 and shall be UL Classified as a Wall Opening Protective Device. The sealant shall be CHASE-FOAM CTC PR-585 Fire Resistant Foam Sealant from Chase Technology Corporation, Huntington Station, New York, 11746, or equals of 3M and T&B.

F. Escutcheon plates - when a conduit passes through a ceiling, wall and/or floor into a finished space, an escutcheon plate shall be installed on the conduit to cover the unfinished hole and sealant.

3.5 PROHIBITED PROCEDURES

A. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.

B. Installation of raceway which has been crushed or deformed.

C. Use of torches for bending PVC.

D. Spray applied PVC cement.

E. Boring holes in truss members.

F. Notching of structural members.

G. Supporting raceway from ceiling system support wires.

H. Nail drive straps for supporting raceway.

3.6 EXCAVATION AND BACKFILL

A. Raceway installation below slab-on-grade, or below grade:

1. The Electrical contractor is responsible for all excavation and backfill related to the electrical installation defined herein and/or as indicated on the plans.

B. UNDERGROUND RACEWAY AND CONDUIT:

1. Bury underground raceway installed outside building 24” deep minimum.
2. Wrap buried galvanized RMC and galvanized IMC conduit and fittings with vinyl tape such as 10 mil Dottie Tape where in contact with earth or concrete.
3. Opening of finished surfaces asphalt concrete, grass, etc. shall be accomplished by first identifying the limits of the opening then cut within the limits preserving the undisturbed areas. Asphalt shall be cut with a wedging tool, concrete with a diamond saw and grass with a cutter.
4. Excavation shall be accomplished with the proper equipment; protective care shall be taken to not disturb the adjacent surfaces and materials. This contractor is responsible and shall protect all material objects and things adjacent to the excavation.
5. All materials not reinstalled in the installation shall be removed from the premise.
6. Backfill the first 6” layer over the installed subject (conduit, cable, etc.) shall be sand. Subsequent 6” layers shall be loan soil. Each layer shall be compacted to a 90% standard proctor test before the next layer is applied. (Refer to Section 260533, Part 3 for conduits required to be encased in concrete).
7. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. Install RMC (with protective coating) for raceways passing vertically through slabs on grade. Slope raceways as required to drain away from electrical enclosures and to avoid collection of moisture in raceway low points.
8. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (½" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020”). Completely wrap and tape all field joints.
9. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
10. Conduits encased in concrete shall be shrouded with a 3" of Red concrete. Install #3 rebar in opposite corners of the encasement except for two conduits or less where two #3 bars in opposite corners is acceptable.

D. RACEWAY INSTALLATION IN SUSPENDED SLABS:

1. Install conduit as close to the middle of concrete slab as practicable without disturbing reinforcement. Do not install conduits of diameter greater than 1¼" of the slab thickness. Space conduits not less than 3 diameters on center (except at stub up locations). Provide OZ expansion fittings at all expansion joints. All raceways shall be installed with concrete tight fittings.
2. Install RMC in all hazardous locations as defined by NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with requirements.

END OF SECTION 260533

SECTION 26 0534 - BOXES, PULL BOXES, CONDUIT BODIES, AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of electrical box and electrical fitting work is indicated by drawings and schedules.

B. Types of electrical boxes, fittings, etc. in this section, or noted on the plans shall include the following:

1. Outlet boxes
2. Junction boxes
3. Conduit bodies
4. Bushings
5. Locknuts
6. Knockout closures
7. Miscellaneous boxes and fittings

1.2 QUALITY ASSURANCE

A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134.1 (NEMA Standards Pub. No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings which have been UL-listed and labeled.

1.3 SUBMITTALS

A. None required.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

A. Interior Outlet Boxes: Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes, of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices; standard box shall be 4" square x 2-1/8" deep, (Raco 231) with ¾" knock outs and tile or **masonry/type** box extensions (Raco 843).

B. If the structure will not allow a 4 in² box use a 3" deep single gang unit (Raco 695).

C. In spaces with restricted width, like between a door frame and window jam, use partition boxes (Raco 426).

D. Interior Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, hangers, masonry extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications. See the details on the plans.

E. Weatherproof Outlet Boxes: Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face application, with face plate gaskets and corrosion-resistant fasteners.

F. Junction and Pull Boxes: Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers. J-box larger than 8 x 8 x 6 shall have a hinged cover.

G. Condulet Bodies (Fittings): Provide galvanized cast-metal conduit bodies, of types, shapes, and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

H. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable iron conduit bushings and offset connectors, or types and sizes to suit respective uses and installation.

2.2 FITTINGS

A. The contractor shall provide **all sheet metallic** connectors, coupling, etc., a needed on this project.

B. When installing non-metallic sheathed cable, all connections to boxes, cabinets, etc., shall be made with screw steel fittings with a locknut connection to the box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface with other work.

B. Coordinate location of outlet for water cooler with Division 22 & 23.

C. Coordinate location of outlets adjacent to or in millwork with Division 06 before rough-in. Refer conflicts to Architect and locate outlet under his direction.

D. Coordinate with Division 23 for installation of exposed raceway in mechanical equipment areas. Exact separation of responsibility is shown on Drawings.

E. Mount switch boxes with long dimension vertical.

F. **Mount receptacle boxes with long dimension vertical**. See Detail 4/ED-1.

G. Boxes shall be accessible and installed with approved cover.

H. Do not locate device boxes which are on opposite sides of framed walls in the same stud space. In other types of wall construction, do not install boxes back to back.

I. Locate boxes so outlets are not obstructed by pipes, ducts, or other items.

J. Install outlets flush with finished surface and level and plumb.

K. Boxes for switches shall generally be located within 6” of door jamb.

L. Properly center single outlets in each room. Where two or more outlets occur, space them uniformly and in straight lines with each other.

M. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.

N. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

O. Minimum height of wall receptacles shall be 18". With the box arranged for vertical mounting of the receptacles (ground slot at the bottom).

P. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

Q. Provide coverplates for all boxes. See Section 260534, Wiring Devices.

R. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

S. Provide knockout closures or cap unused knockout holes where blanks have been removed.

T. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Install recessed boxes with face of box or ring flush with adjacent surface so the device mounting flange sets on the box mounting plate. This will cause the device and coverplate surfaces to match.

U. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them.

V. Provide electrical connections for installed boxes.

W. The nonmetallic-sheathed cable installation shall be installed using metallic boxes and associated hangers.

END OF SECTION 260534

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. All electrical equipment, distribution panels, motor control centers, conduit, device boxes, apparatus, etc., shall be securely anchored and/or supported in place as specified herein and/or in accordance with state, local, and seismic codes.

1. Work of this section includes supports, anchors, sleeves, and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hold conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, and all associated accessories.
2. Quality Assurance: Comply with NEC and local codes as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub. No. FB 1, “Fittings and Supports for Conduit and Cable Assemblies”. Provide electrical components which are UL-listed and labeled.
3. Manufactured Supporting Devices and Raceways: Provide manufactured mounting brackets (such as Caddy #SDG or SDB - D - 16); complying with manufacturer’s standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawing details for additional requirements.
4. Tie-wire is not acceptable.
5. Supporting of equipment may be noted in other sections of the specifications.

B. Wall supported equipment shall be mounted on an angle support bracket with anchors into or through the wall as perimeter (the latter mounting is preferred, but must be approved by the architect), with two ½" rods up to the structure from the outer most corners of the mounting frame tied-off to the building structure. This would be likened unto a transformer. Wall mounted electrical panels shall be mounted directly to the wall.

C. For hanging of conduit, see Section 260533.

D. Installation of Supporting Devices for all types of Raceways: Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to ensure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

1. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
2. Install hangers, supports, clamps and attachments to support piping properly from building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible.

3. Raceways (All Types): Support raceways which are rigidly attached to structure at intervals not to exceed 8’ on center and within 12" of each junction box, outlet or fitting. Support raceway (as it is installed) in accordance with the following:

NUMBER OF RUNS	MIN. ¾" TO 1½"	1½" & LARGER
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3	Mounting Channel	Mounting Channel

4. Support suspended raceways on trapeze hanger system, or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.
5. Install electrical raceways where indicated; in accordance with manufacturer’s written instructions, applicable requirements of NEC and NECA “Standard of Installation”.
6. Coordinate with other work, including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.
7. Coordinate the campus ground equipment installation with existing structures, trees, lawn sprinkler systems, etc.
8. Install raceway in accordance with the following:
   a. Provide a minimum of 12" clearance from flues, steam, and hot water piping, etc.

E. Floor Mounted Equipment: Provide rigid attachment of all floor mounted equipment to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90º corner and at intervals not to exceed 48" on center along entire perimeter of the equipment. Provide rigid attachment for all floor mounted switchboards, panelboards, power and control equipment, motor control centers, dimmer cabinets, transformers, oil switches, battery packs and racks, and similar equipment furnished under Section 26.

F. Buried Conduit: Conduit installed in the earth shall be laid on undisturbed soil and/or compacted fill. The first 6” of cover shall be sand. See Excavation and Backfill -see Section 260533-3.6.

G. Concrete slabs, bases, curbs, etc., for electrical apparatus shall be provided and installed under this contract. The concrete shall be 5-bag mix, except as noted.

1. The contractor shall provide and install an 8 x 8 x 4 concrete base for the transformer (confirm size and depth with the service utility) at the indicated location.
2. Unless otherwise noted, provide a 4" high concrete base for all main panels, motor control centers, transformers, engine generators, etc. Extend base 4" beyond equipment or mounting rails on all sides or as shown on the drawings. Coordinate the pad dimension with the equipment to be located thereon.
3. Concrete pole bases (detailed on the plans) shall be provided under Division 26. Coordinate size and location of all bases and furnish all required anchor bolts, sleeves and templates as required to obtain a proper installation.
4. All concrete used on this project shall be 5-bag mix and/or as specified in the concrete section of the Architectural Section.

PART 2 - SEISMIC BRACING

2.1 GENERAL

A. The General Conditions, Supplementary General Conditions, Alternates and Addenda, Applicable Drawings and the Technical Specifications shall apply to all work under this division.

B. This seismic bracing section shall conform to the conditions governing the area within the structure being built under local and/or state UBC Seismic Requirements.

2.2 SCOPE OF WORK

A. The materials covered by these specifications consist of furnishing all labor, material, and equipment necessary to complete the seismic bracing for all work provided under section 260000.

B. The work shall include all electrical isolated and non-isolated equipment, luminaires, raceways, etc.

2.3 CODES - REGULATIONS

A. In the installation of this work, comply in every way with the requirements of the laws, ordinances and rules of the system design and installation shall be based on seismic zone III of the Uniform Building Code, current edition and other standards listed below.

B. Reference Standards:

1. Uniform Building Code current edition, especially Sec. 2336
2. NFPA bulletin 90A, current edition
3. UL Standard 181
4. Tri-services manual, fagel etal 1978

C. If a conflict occurs between these rules and this specification, the rules are to govern. Accept this condition upon submitting bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the contractor from complying with any requirements on the plans or specifications which may be in excess of requirements of the hereinbefore mentioned rules and not contrary to same. Contractor shall bear all costs arising from the installation of any materials or equipment which is in conflict with the above-mentioned codes or ordinances.

D. Obtain approvals, inspections, etc., required by code. All fees shall be included in the contract price. The contractor shall furnish a certificate of approval to the Owner's Representative from the inspection authority at completion of the work.

2.4 MATERIALS AND WORKMANSHIP

A. All materials and equipment furnished and installed shall be first quality, new and meet the standards of NEMA, IPCEA, LS, UL, NFPA, UBC, UOSH, NEC, and shall bear their label wherever standards have been established and label service is available. Where materials and equipment are specified by manufacturer's name, and type and quality required is thereby denoted. The Owner's Representative shall be afforded every facility, deemed necessary to inspect and examine the materials and apparatus being installed to provide their quality, skill and competency of workmanship.

B. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts,

and practices and shall be acceptable in every respect to the Owner's Representative. Nothing contained herein shall relieve the contractor from making good and perfect work in all details of construction.

C. The contractor shall work in harmony with the Owner's Representative and with other contractors, companies or individuals working in connection with this project. Imperfections or errors by other contractors shall not relieve responsibility of this contractor. Store materials orderly and clean up without interference.

2.5 QUALITY ASSURANCE

The contractor shall be held responsible for purchasing and installing vibrator isolators, flexible connections, rigid steel frames, concrete inertia bases, anchors, inserts, hangers, and attachments, seismic bracing and snubbers as required for seismic control and prevention of the transmission of vibration for both isolated and non-isolated systems.

A. Manufacturers and suppliers approved for use by the contractors Mason Industries, Inc., Korfund, and Amber/Booth Company.

B. The approved manufacturer or supplier shall be totally responsible for the fabrication and operation of the seismic bracing components specified herein for all isolated equipment, non-isolated equipment, luminaires, raceways, etc.

2.5 GUARANTEE

A. The entire electrical system installed under this contract shall be left in proper working order and be in compliance with the drawings, specifications and/or authorized changes to the satisfaction of the Owner's Representative. Without additional charge, replace any work or materials which develop defects, except from ordinary wear, within one year from the date of substantial completion. A written guarantee covering the above provisions shall be signed and delivered to the architect after the project has final acceptance by the inspecting authority.

PART 3 - PRODUCTS

3.1 ISOLATED EQUIPMENT

A. All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases. Each spring mounted base shall have a minimum of four all directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. The snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications.

B. Elastomeric, 50 durometer, materials shall be replaceable and a minimum of ¾" thick. Snubbers shall be manufactured with an air gap between hard and resilient materials of not less than 1/8" nor more than ¼". Snubbers shall be installed with factory set clearances.

C. The capacity of the seismic snubbers at 3/8" deflection shall be 3 to 4 times the load assigned to the mount grouping in its immediate area.

3.2 NON-ISOLATED EQUIPMENT, RACEWAYS, ETC.

A. All non-isolated equipment shall be installed according to current Uniform Building Code Sec. 2312 (g): Cp Factor Table 23J, I Factor Table 23K. In addition, the vertical forces, restraint requirements shall be computed as .5g the value of the lateral forces.

B. All non-isolated raceway shall be protected against seismic disturbances except as noted below:

1. All electrical conduit less than 2" inside diameter.

PART 4 - EXECUTION

4.1 SEISMIC REQUIREMENTS

A. All electrical work shall be braced, snubbed, or supported to withstand seismic disturbances and remain operational. Furnish all labor, materials, and equipment to provide protection against seismic disturbances and remain in place.

4.2 SHOP DRAWING SUBMITTAL AND REVIEW

A. Submit complete, bound submittal in a loose-leaf binder large enough for all items (8 copies) to architect after award of contract. All such submittals shall include, but are not necessarily limited to, the following:

1. Complete engineering calculations and shop drawings, prepared and stamped by a licensed engineer (UBC 302-6) for all seismic requirements for all equipment that is to restrain raceways, etc.
2. The type, size and deflection of each isolator proposed for items in this specification and on the drawings.
3. Details for all the isolators and seismic bracing with snubber proposed for items in this specification and on the drawings.
4. Details for steel frames and concrete inertia bases to be used in conjunction with the isolation of the items in this specification and drawings.
5. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing, and snubbers.
6. The size, loading and location of raceway supports with either a plan or complete description of the system.

B. All items must be submitted at the same time. Partial submittals will not be accepted. Binders and indexes will remain in possession of engineer, architect, contractor, and sub-contractor.

C. Review is for assistance and interpreting the design concept. Changes in requirements will not be made in the review process. Review action does not exempt requirements to meet the intent of the contract documents. Any changes will be made by change order. Items not included in the submittal or incorrectly selected shall be in accordance with the contract requirements.

END OF SECTION 26 0548

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Electrical Contractor is responsible for the labeling of all electrical equipment for this project. The labels shall be made on 1/8” laminated micarta and an engraving machine as stated below.

B. Labeling and Engraving: Any and all electrical control equipment shall be labeled with an engraved black Micarta with white core labels, 1/16" thick, shall be bolted on the interior and the exterior of branch panels (panel name and voltage) and the exterior of disconnect switches, motor controls, major J-boxes (power and auxiliary), push buttons, thermal switches, time switches and similar equipment. The labels shall have ¼" high engraved letters, such as 1½ HP FAN, PANEL - A. All main panel circuits shall be identified with Micarta labels. (RED MICARTA LABELS shall be used on emergency powered equipment.)

C. The phase of each feeder conductor shall be **color coded** at each end in panels and junction boxes as stated in Section 260519 - 2.1. The feeder powers shall be attached to the bundle of cables with a tie-wrap.

D. Conduit shall be installed as diagramed on the plan. Any deviation shall be authorized in writing prior to rough-in.

E. A plastic label, as noted above with the **name and address of the Engineer: Nielson Engineering, Inc., Pocatello, Idaho, Phone 208-232-2577** - the profession indicated - shall be bolted to the front of the Main Power Panel. The engraved letters in the name and address shall be ½" and ¼" high, respectively.

F. **Write with a felt tip pen that contains permanent ink, on the inside of each device box and on the back of every plate, the circuit to which the device is connected. Example: Circuit “A-1".**

G. Three power riser diagrams sealed in plexiglass and trimmed with a metal frame shall be provided and installed at Main Panel M in the switch gear room (locate as directed) and at Panels MM and MB.

H. Engraving device plates - see Wiring Devices.

END OF SECTION 260553

SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 26, 27, and 28 Specification Sections, apply to this Section.

B. OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY

A. This Section includes the following:

1. General requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

B. The goal of the commissioning process for the commissioning is to verify for the Owner's Representative that the commissioned systems function interactively and in compliance with the design intent, and to facilitate the orderly and efficient transfer of the systems to the Owner.

1. Commissioning is the process for achieving, verifying, and documenting that the performance of a building and its various systems, meet the design intent and the Owner's Representatives operational needs.
2. Commissioning tests the operation of the equipment and building systems to ensure that they operate as designed and can satisfactorily meet the needs of the building throughout the entire range of operating conditions.
3. Commissioning is a cooperative effort that requires participation by the Owner's Representative, Contractor, Installers, Engineer, Commissioning Agent, and Code Authority.

C. Test Procedures: Equipment test procedures of the specific manufacturer to be used in the commissioning process may be modified or expanded to accurately address equipment of the specific type used and manufacturer used for this project.

D. Commissioning is not intended to be a testing or inspection function that is a substitute for the Contractor's obligations for startup, system adjustment, testing, proof of performance, or contract closeout.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings to be held weekly.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete electronic construction checklists, as Work is completed, and provide to the Commissioning Authority weekly.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1% to 100%. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

1.8 SYSTEMS TO BE COMMISSIONED:

A. Lighting Control (265110)

1. Lighting Control Systems by Room

B. Intrusion Detection System (281000)

C. Electrical Power Monitoring (260913)

1. Panel MDP

D. Generator (263213)

1. Generator

E. Integrated Electronic Communications Network (275100)

1. Intercom System

F. Sound Re-Inforcing and Recording Systems (275150)

1. Classroom Sound Enhancement
2. Gymnasium Sound System
3. Cafeteria Sound System
4. P.E. Sound System

G. Fire Alarm System (283123)

1. Fire Alarm System

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 260800

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide and install the lighting controls as noted, which shall include the controls, accessories, boxes, etc., to make the installation complete and operable.

1.2 LED LIGHTING CONTROL SYSTEM

A. Provide an LED lighting control system when shown and specified on the plans. LED luminaire shall be equipped with a driver approved for the control system. Daylight sensors, occupancy sensors, low voltage switches, WIFI programming modules, etc., shall be commissioned as required by the International Energy Conservation Code.

B. The contractor shall operate the lamps for at least 100-hours before activating the dimmer equipment.

C. Hubbell, Lutron, Leviton, Tork, Acuity Brands, or Sensor Switch are approved equals provided they meet the specifications and functions of the named units' criteria. If the substituted units do not perform all the functions, the contractor shall provide the named and/or specified equipment.

D. Submission: The contractor shall coordinate exact sensor location with manufacturer by submitting to the manufacturer a layout of the sensors for his review and evaluation. After the manufacturer has approved and endorsed the submitted plan, it shall be issued to the engineer as a shop drawing. The manufacturer shall provide the sensors as needed to perform the function and intents of the design.

E. Lighting controls on emergency battery egress luminaires shall be UL924 compliant.

1.3 ELECTRONIC PHOTO CONTROL

A. The contractor shall provide and install photo switches/relays as noted on the plans. The photo switch shall be located at the indicated point and/or a location that will read daylight and wired into the system so that it will control the operation wherein it is placed.

The photo-switch/relay shall be such as Intermatic #EK4236S, with equals of Paragon as being acceptable.

1.4 TIME SWITCHES

A. The contractor shall provide and install a time-controlled switch of the type noted on the plans. The switches shall have two 40A switches for operation with a resistance or inductive load. The clocks shall operate on 120V AC with a 24-hour over-rice on power failure. The switches shall be as follows (with Tork and Paragon as an acceptable equal):

1. 24-hour timer shall be Intermatic #T173CR
2. Astronomical timer shall be Intermatic #ET2845CP
3. Elapse timer shall be Intermatic No. FF60MHC

B. Photo-switch/relay shall be long life design per ANSI C136.10.11.7, such as Intermatic

EK4246S, with equals of Tork, Paragon, as being acceptable.

1.5 LIGHTING CONTACTORS

A. The contractor shall provide and install multi-pole lighting contactors as shown on the plans. The scheduler may indicate more than the 4-pole, 30A, specified herein. If that be the case, provide the number of poles specified. The contactors shall be mechanically held 120-Volt coils such as Square “D” No. 8903 LG 1000 V02 or as noted in the schedule on the plans.

END OF SECTION 260923

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of this work is to provide, install and connect a main service disconnect and distribution switchboard as indicated on the drawings.

B. Furnish distribution sections shall be mounted on a concrete curb and tied together as if it were factory installed as a single unit. The total unit shall be anchored to the pad at each corner -see Section 260529.

1.2 QUALITY ASSURANCE

A. Provide units which have been UL listed and labeled. Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC pertaining to installation of wiring and equipment in hazardous locations. Comply with NEMA Stds. Pub. No. 250, “Enclosures for Electrical Equipment (1000 volt maximum)”. Pub. No. 1 “Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less”, braced for 100,000A SCA.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.

B. Shop Drawings: Submit dimensioned drawings of main service disconnect and distribution switchboard with accurately scaled layouts of enclosures and required individual switchgear, including, but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

PART 2 - PRODUCTS

2.1 METER SECTION

A. The contractor shall provide and install a meter base and/or section as shown on the plans. These sections shall be sized to the service conditions.

B. The serving utility has definite requirements for meter section to monitor to power used in this building. The contractor shall provide and install the utility required EUSERC meter equipment. The contractor shall contact the utility company and confirm the units indicated on the plans. The contractor has the responsibility and shall provide the required equipment regardless of what is shown on the plans.

2.2 MAIN DISCONNECT AND SWITCHBOARD (EUSERC APPROVED)

A. Switchboard: Floor standing, dead front, dead rear, with all bussing and equipment accessible from the front, constructed in accordance with the feeder diagram and approved shop drawings. Each section of the switchboard shall bear the Underwriters label and manufacturer’s label and shall comply with all applicable codes and ordinances. Provide black and white bakelite nameplates identifying each function and each circuit breaker in the switchboard.

B. Where Spaces are Indicated, Busses: Extended full length and complete with mounting holes and/or hardware for the installation of future equipment.

C. Pull section if specified shall be constructed like unto the distribution panel as to height, color, and finish.

2.3 DISTRIBUTION PANEL

A. All Circuit Breakers, Switches, and Other Interior Equipment: Mounted to the framework and no equipment mounted to the front plates except as allowed by applicable codes and defined detailed on the plans and/or in the schedule.

B. Design of all current carrying devices or parts of the switchboard shall conform to the latest standards specified in the related section of IEEE standards except as these characteristics may be modified herein.

C. All control and secondary wiring insulated for the voltage indicated in the schedule. All primary connection uninsulated except for special installation where insulation is specified, or unless insulation is required to make the equipment comply with the required dielectric test.

D. Standard test for all switching and control apparatus system 61 to 600 volts; 1500 volts for 1 minute; where the standards on devices used on this equipment call for a lower test voltage, such devices may be disconnected during the test. Voltage tests made in accordance with ASA Standard C68.1.

E. Switchboard sections constructed of a code gauge steel to the dimensions indicated in the schedule or on the plans. Holes, supports, studs, and openings standardized to enable interchange or interior and front cover units. Sections fabricated with right angle corners and plumb edges and surfaces.

F. This panel is designed for installation in a certain space, the indicated **physical dimensions** are critical and **must be strictly followed.**

G. Enclosures, parkerized or bonderized as a unit after all welding has been completed, then painted with a rust-resisting prime coat of paint. Back of the enclosure and the interior finished with a coat of light grey baked enamel and the front, top, and exposed sides shall be finished with a scratch-resistant silver-grey hammertone finish.

H. Wiring gutters extend the full depth of the switchboard front - front to back.

I. Bus bars, connection bars, and wiring on the back of the switchboard arranged so that maximum accessibility is provided for cable connections.

J. Consideration given to the arrangement of cables so they may be connected to the switchboard in an orderly manner. Electrical clearance between parts of opposite polarity and between live parts and ground shall conform to the National Electric Code.

K. Each distribution section bussed for the full connected load of the section. Bussing in all sections shall extend to all spare circuit breaker spaces, the busses drilled, taped and with straps or other mounting accessories.

L. Bus Bars: Tin, aluminum, or tined copper, meeting cross sectional area of UL Standard 891 for temperature rise. The through bus shall be 100% rated, neutral bus 100% rated, provided with CU/AL lugs. Ground bus sized to UL 891.

M. ampere ratings: The switchgear shall be the rating indicated on the plans and in accordance with the latest applicable standards of IEEE and NEMA.

N. Bus Bracing Supports: The bus work shall be braced to meet the short-circuit rating indicated on the plans. Cables shall not be used in lieu of bus bars, riser busses, connection busses or bus jumpers. All bars, riser busses, connecting busses, and bus jumpers adequately supported. Bus bars of a length greater than 15" but less than 30" shall be supported with not less than one intermediate insulated support (Underwriter approved) unless the bar is taped with one layer of friction tape, half lapped, and the entire taping thoroughly varnished with approved insulating varnish. Bus bars of a length greater than 30" shall not have less than two insulated supports; sufficient supports shall be provided so that the distance between supports shall not exceed the width of the switchboard section in which they are used. Bus bars shall extend through all spare circuit breaker spaces in switchboards.

O. Ground Bus: A ground bus shall extend throughout the length of the switchboard assembly. Each assembly housing shall be grounded directly to this bus.

P. If the panel is shown as an outside installation, it shall be NEMA 3R with hinged locking doors.

2.4 ACCEPTABLE MANUFACTURER

A. Subject to compliance with requirements, provide ground-fault sensing and relaying equipment of one of the following:

1. Square D Co.
2. Siemens
3. Eaton

PART 3 - EXECUTION

3.1 GENERAL

A. Torque tighten all bolted connections of bus bars in all switchboards. All torque settings shall conform to NEMA, code and industry standards.

B. Rigidly secure and bolt switchboards to the building construction in an approved manner to resist seismic stress. Secure from the switchboard manufacturer all necessary calculations and drawings required to meet seismic conditions and be responsible for obtaining written approval of installation from proper authorities.

C. Provide approved attachments for padlocking each circuit breaker or fused switch in the OFF position.

D. The conduits connected to the switchboard shall be mounted in an approved place, the holes shall be carefully cut and sured in place with locknuts and bushings.

E. Cable connections to the main and distribution circuit breakers shall be installed in proper size lugs and torqued in place as per the manufacturer’s recommendation.

F. Provide selective coordination of all breakers per NEC 700.27 and 701.27 using the definition in Article 100 (NEC2014).

3.2 IDENTIFICATION

A. Main and distribution circuit breakers shall be labeled in accordance with the label specifications, name of Engineer and Contractor. Also install a label with the Electrical contractor and Engineer's name to be mounted on the main disconnect. See Section 260553, Labeling.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of panelboard and enclosure work is indicted by drawings and schedules.

B. Types of panelboards and enclosures in this section include lighting and appliance panelboards, and power distribution panelboards.

1.2 QUALITY ASSURANCE

A. Provide units which have been UL listed and labeled. Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC pertaining to installation of wiring and equipment in hazardous locations. Comply with NEMA Stds. Pub. No. 250, "Enclosures for Electrical Equipment (1000 volt maximum)". Pub. No. 1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".

1.3 SUBMITTALS

A. PRODUCT DATA

1. Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.

B. SHOP DRAWINGS

1. Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including, but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one Square “D” Company - NQ, NF, or I-Line Type.

B. Approved Manufacturers

1. Square “D” Company
2. Siemens
3. Eaton

2.2 PANELBOARDS

A. GENERAL

1. Except as otherwise indicated, provide panelboards, enclosures, and auxiliary components, of types, sizes, and ratings indicated. Equip with number of unit panelboard devices as required for complete installation. Fully equip “spaces” with hardware to receive breaker or switch of size indicated.

2.3 LIGHTING AND APPLIANCE PANELBOARDS

A. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangement shown, provide bolt-on thermal magnetic type branch breakers. Where multiple breakers are indicated, provide with common trip handle. Equip with aluminum bus bars full-sized neutral bus, ground bus and isolated ground bar when indicated.

2.4 PANELBOARD ENCLOSURES

A. Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gauge minimum 16-gauge thickness. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor. Provide enclosures fabricated by same manufacturer as overcurrent devices contained therein. Bolt engraved Formica labels indicating panel name and voltage on the interior and exterior of panelboards.

2.5 FINISH

A. Coat interior and exterior of surface with manufacturer’s standard color; baked on enamel finish.

2.6 IDENTIFICATION

A. Provide 1/16" thick black Micarta labels with ¼" high lettering on the interior and exterior of each panelboard; include panelboard name and voltage - see Section 260553.

2.7 BRANCH CIRCUIT BREAKERS

A. Provide and install branch circuit breakers of the size, type and amperage indicated, mounted in the position noted in the panel schedule.

The circuit breakers shall be as defined by NEMA as a device designed to carry electric current through a set of contacts and by automatic means open the contacts, interrupting the flow of current when the flow of current exceeds the labeled rating or on a high instantaneous inrush of current. The tripped breaker shall flag the interruption of the flow of current and be capable of being reset when returned to normal operating temperature. The breaker shall be a molded case unit that will open on an overload and/or short-circuit condition.

The unit shall be constructed as molded case units having a single handle operator for one, two or three pole units. For multiple pole units, and overload on any pole shall cause all terminals to open.

PART 3 - EXECUTION

3.1 GENERAL

A. Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", in compliance with recognized industry practices to ensure products fulfill requirements.

B. Position the breakers in the panel to match the schedule on the plans.

C. Coordinate installation of panelboards and enclosures with cable and raceway installation work. Anchor enclosure firmly to walls and structural surfaces, ensuring they are permanently and mechanically secure. Arrange conductors neatly within enclosure, and secure with suitable nylon ties.

D. Fill out panelboard's circuit directory card upon completion of installation work. Utilize actual final building room numbers, not architectural numbers used on drawings. Identify individual lighting circuits and individual receptacle circuits by room served. Include room number with equipment circuit designations. All directories to by typewritten.

E. Provide selective coordination of all breakers per NEC 700.27 and 701.27 using the definition in Article 100 (NEC2014).

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as a unit of an electrical system that carries or controls electric energy as its principal function.

B. Types of electrical wiring devices in this section include the following:

1. Switches
2. Receptacles
3. Cord caps and connectors
4. Low voltage switching
5. Floor mounted power and telephone/data outlet
6. Phone jacks and plates
7. Data jacks and plates
8. Phone/Data jacks and plates
9. Wiring device accessories

1.2 QUALITY ASSURANCE

A. Comply with NEC and NEMA standards as applicable for construction and installation of electrical wiring devices. Provide electrical wiring devices which have been UL listed and labeled.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

2.1 FABRICATED WIRING DEVICES

A. GENERAL: Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub. No. WD 1. The devices shall be white with white coverplates.

B. Provide wiring devices (of proper voltage rating) as follows:

SWITCHES		(20A Continuous Rating)		
MFGR.	1-Pole	3-Way	4-Way	W-Pilot
Hubbell	DS120W	DS320W	DS420W	HBL1221PL
P&S	2621W	2623W	2624W	PS20AC1RPL(7)
Eaton	7622W-Box	7623W-Box	7624W-Box	AH1221PL
Bryant	9901W	9903W	9904W	4901PLR(*)

RECEPTACLES			(20A Continuous Rating)		
MFGR.	C.O.'s	GFI (Weather-Resistant)	Controlled	Hospital (Green Dot)	IG (Orange)
Hubbell	SNAP5362WA/SNAP2RA	GFR5362SGW	SNAP5362CIWA	HBL2182WA	IG 2162
P&S	5362-AW/Plugtail	2097TRWRAW	5362CHW	26362HGW	IG 26362
Eaton	AH5362W	TWRSGF20W	5362CHW	8362W	IG8362RN

C. Special devices as indicated on the plans, complete with matching coverplates shall be provided and installed where indicated.

D. All weatherproof covers on receptacles (GFI) and/or switches shall be mounted on a recessed box. Cover shall be made of cast aluminum such as Arlington Industries #DSHBIBRC. Equals of T&B and TayMac are acceptable. GFI receptacle shall be weather resistant as indicated in schedule above.

E. Provide devices in colors selected by Architect.

F. Contractor shall provide and install tamper resistant receptacles where required by NEC 406. If P & S/Eaton do not have tamper resistant version of specified device, provide Hubbell tamper resistant version where required.

2.2 CORDS CAPS AND CONNECTORS

A. Provide 3-wire grounding, cap plugs, and connectors of ampere and voltage rating required, for final equipment connection, and as indicated otherwise on drawings. Provide products of one of the following manufactures:

1. Arrow Hart
2. General Electric
3. Hubbell
4. Leviton
5. Pass and Seymour
6. Bryant

2.3 LOW VOLTAGE SWITCHING

A. Provide and install the equipment and materials necessary for the installation of low voltage switching network in the areas indicated on the plans. The low voltage conductors shall be installed in conduit in compliance with the specifications heretofore covered. The boxes and plates shall match the wiring device equipment heretofore covered.

B. All equipment shall be installed as per the manufacturer's instructions.

2.4 COMBINATION FLOOR MOUNTED POWER AND TELEPHONE/DATA OUTLET

A. The contractor shall provide and install a floor box with carpet and/or tile cover that will have recessed space for power, phone, and data receptacles. Coordinate type of flooring prior to ordering floor box cover. The power receptacle shall be standard receptacle heretofore covered, except as otherwise defined. The phone (orange) and data (blue) jacks shall be as noted below. The receptacles and jacks shall be incorporated in Hubbell #CFB2G30CR/24G*CVR**** or equals of T & B, Wiremold. Verify face plate types required prior to purchase.

2.5 WIRING DEVICE ACCESSORIES

A. WALL PLATES: Provide and install high impact, smooth, white nylon coverplates for all wiring devices. Provide galvanized steel plates in unfinished or kitchen areas. Engrave all receptacle plates other than those serving 120 volt, single phase devices. State voltage and amperage characteristics. Example: "208V, 30A".

B. All switch banks shall have each switch identified as to its function with 1/8" thick laminated micarta engraved adhesive plate.

C. Weatherproof coverplates shall be Arlington Industries #DSHBIBRC. Equals of T & B and TayMac are acceptable.

D. Emergency power coverplate shall be "RED", engrave "Emergency Power" on coverplate.

PART 3 - EXECUTION

3.1 GENERAL

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other trades (including painting), the installation of electrical boxes and wiring. Install devices in boxes such that front of device is flush and square with coverplate. Drawings are small scale and, unless dimensioned, indicate approximate locations only of outlets, devices, equipment, etc. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinated with other work. Verify all dimensioned items on job site. Consult architectural cabinet, millwork, and equipment shop drawings prior to rough-in of electrical work.

C. Receptacles: **The receptacles shall be mounted vertically** with the neutral terminal or slot at the left side.

D. Install devices only in electrical boxes which are clean, free from excess building materials, dirt, and debris. Mark each box and the back of each device plate, with felt tip marker, indicating the circuit or port to which the device is connected. Example: "CKT A-1".

E. Install blank plates on all boxes without devices.

F. Delay installation of wiring devices until wiring work is completed. Delay installation of wall plates until after painting work is completed.

G. Do not Edison or share neutral conductors between phases.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES

A. At time of substantial completion, replace those items which have been damaged, including those stained, burned and scored.

3.3 GROUNDING

A. Provide electrical continuous, tight grounding connections for wiring devices, unless otherwise indicated.

3.4 TESTING

A. Prior to energizing circuitry, test with a hand test device that proves electrical connections: continuity, proper polarity, grounding, neutral connection, etc. Any irregularities shall be corrected.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The contractor shall provide and install overcurrent protective fuses as noted on the plans. The fuses shall be sized to the apparatus that is being protected. Example: a motor fuse (motor rated) to the full load amperes noted on the name-plate of the motor.

B. Fuses specified for non-motor loads shall be sized to the overcurrent gear wherein they are to be installed.

1.2 FUSES

A. Furnish and install fuses in all switchboards, panelboards, motor controls, disconnecting switches and all other equipment requiring fuses which are furnished by this Contractor.

B. Do not ship switchboards, distribution panelboards, switches, etc. from the factories and/or deliver to the job with the fuses installed in place.

C. Fuses, 601 amperes or larger: Bolt-on NEMA Class L, current limiting with 200,000 amperes RMS symmetrical, interrupting capacity. Fuses for switches in main distribution limiting with 200,000 amperes RMS symmetrical, interrupting capacity. Fuses for switches in main distribution switchboards shall have at least 45 seconds time delay at 3000% rating.

D. Fuses, 600 amperes or less, on circuits serving motor loads and dry-type transformers: Dual-element with minimum time delay of 10 seconds at 500% rating. They shall also be current limiting and shall have interrupting capacity of 200,000 amperes RMS symmetrical.

E. Fuses, 600 amperes or less, on circuits serving switch or breaker distribution panels, lighting panelboards and other non-motor loads: Current limiting and shall have interrupting capacity of 200,000 amperes RMS symmetrical. These fuses do not have to be time delay type.

F. All fuses of the same manufacturer, have characteristics to insure retention of positive selective coordination as designed, be of the sizes shown on riser diagrams and schedules, and were not indicated on drawings, of the required size for proper operation of the equipment protected.

G. Fuses: Class "R" rejection type, "LPN-RK".

H. General: Except as otherwise indicated, provide fuses of types, sizes and ratings and electrical characteristics as follows. Provide fuses labeled UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes.

I. Main Service and Feeder Circuit: For fuse ratings over 600 amperes provide UL Class L Fuses (KTX, KTS, KTU). For fuse ratings up to 600 amperes, provide UL Class RK1 (LPN-RK, LPS-RK). If fuse directly feeds motor or transformers, provide UL RK1 time delay.

J. Branch Circuits: For motor circuits and transformer circuits, provide UL Class RK5 (FRN, FRS). For other circuits, provide UL Class RK5, non-time delay (LPN, LPS).

K. Manufacturer: Subject to compliance with requirements, provide fuses of one of the following:

1. Bussman Mfg. Co.
2. Gould, Inc.
3. Littlefuse

L. Spare Fuses: Provide one spare set of fuses for each size and one spare set for each additional group of five.

1. Spare fuses to be placed in fuse cabinet located adjacent to main panel. Cabinet to be labeled "Spare Fuses".

1.3 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test the equipment for continuity of circuitry and/or short/circuits. Correct malfunctioning units, and then demonstrate compliance with requirements. If the unit is not tested and the fuse ruptures, the contractor is responsible.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of motor and circuit disconnect switch and/or circuit breaker is indicated on the plans and schedules. Work includes complete installation and electrical connections.

1.2 QUALITY ASSURANCE

A. Provide motor and circuit disconnect switches, and/or circuit breaker (as noted), which have been UL listed and labeled. Comply with applicable requirements of NEMA Standards Pub. No. KS 1, and NEC.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data including specification, installation instructions and general recommendations, for each type of motor and circuit disconnect switch required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subjects to compliance with requirements, provide products of one of the following (for each type of switch):

1. Square D Company
2. Siemens
3. Eaton Corp.

2.2 FABRICATED SWITCHES

A. GENERAL

1. Provide heavy duty type disconnect and safety switches as indicated herein.
   a. Heavy duty switches on 240 and/or 600 volt rated circuits.
   b. HP rated switches on all motor circuits.

B. HEAVY DUTY SWITCHES

1. Provide heavy-duty type, sheet-steel enclosed switches, fusible or non-fusible as indicated of types, sizes and electrical characteristics indicated; rated 240 and/or 600 volts, 60 hertz; incorporating spring assisted, quick-make, quick-break switches which are so constructed that switch blades are visible in OFF position with door open. Provide single phase or three phase with solid neutral as required by applications. Equip with an **interlocked operating handle** which is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application, unless noted. Provide fusible switches with Class R rejection fuse clip kits.

C. FUSES

1. Where indicated, provide fuses for switches, as required of classes, types and ratings needed to fulfill electrical requirements for services indicated. Provide spare fuses amounting to one spare fuse for each 10 installed but not less than three of any one type and size. See Section 262813 for fuse types.

D. CIRCUIT BREAKERS

1. Provide and install circuit breakers of the size noted on the plans. They shall be installed in a NEMA 1 enclosure unless otherwise noted.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products fulfill requirement.

B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches with motor drive appliances, and motors and controllers within sight of controller position.

END OF SECTION 262816

SECTION 262910 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of overcurrent protective device work is indicted by drawings and schedules. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures, and for installation as integral components of switchboards and panelboards. See Section 262413, Switchgear and Switchboards, and Section 262416, Panelboards.

B. Types of overcurrent protective devices in this section include the following for operation at 600 volts and above:

1. Molded case circuit breakers
2. Power circuit breakers
3. Fusible switches
4. Molded case systems breakers
5. Phase failure

C. Refer to other Division-26 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.2 QUALITY ASSURANCE

A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent protective devices.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.

B. Shop Drawings: Submit layout drawings of overcurrent protective devices, with layout of circuit breakers, including special relationships to proximate equipment.

C. Maintenance Stock, Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than two units of each size and type.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER’S (LOW VOLTAGE)

A. Subject to compliance with requirements, provide products of one of the following (main and branch manufacturer must be same as panelboard and/or switchboard manufacturer):

1. Circuit Breakers and Fusible Switches
   a. Square “D” Co.
   b. Siemens
   c. Eaton Corp

2.2 MOLDED CASE CIRCUIT BREAKERS

A. Provided factory-assembled, molded case circuit breakers for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers and amperage, voltage and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40º C. Provide with mechanical screw type removable connector lugs, AL/CU rated.

B. All breakers in the main distribution panel shall have sufficient interrupting capacity to safely interrupt the available short circuit current from the transformer bank. Circuit breakers shall be Square "D", Type FH, KH, LH, MH, or as noted on the plans.

C. All breakers specified with motor starters shall be Square "D" Mag-Guard.

2.3 FUSIBLE SWITCHES

A. Provide factory-assembled fusible switch units for power distribution panelboards and switchboards, and for individual mounting as indicated. Provide switch units of amperage, voltage, and RMS interrupting rating as shown, with quick-make, quick-break mechanisms, visible blades, and dual horsepower ratings. Equip with lockable handles with on-off indication. Interlock switch covers with handles to prevent opening in "ON" position. Provide switch with Class R rejection fuse clip kits.

B. Acceptable Manufacturer

1. Subject to compliance with requirements, provide ground-fault sensing and relaying equipment of one of the following (manufacturer must be same as panelboard and/or switchboard manufacturer):
   a. Square D Co.
   b. Siemens
   c. Eaton

2.4 PHASE FAILURE EQUIPMENT

A. Provide and install single phase reverse phase relay (Square “D” PR 101-PLR) that will tie to the main circuit breaker in Panel M to open on abnormal service power. Provide a 120-volt source of power to operate the equipment.

B. Ground-Fault Relay

1. Provide solid-state ground-fault relay, which requires no external source of electrical power, drawing energy to operate GFP system directly from output of current sensor. Construct with adjustable pick-up current sensitivity for GF currents from 200 to 1200 amperes, with calibrated dial to show pick-up point settings. Provide factory-set time delay of 0.5 seconds and protection which precludes tampering with setting after installation.

C. Current Sensors

1. Provide zero sequence current sensors for overcurrent protective devices: inputs compatible with relay. Construct sensor frame so it can be opened to prevent removal or installation around conductors without disturbing conductors. Provide test winding in sensor for testing operation of GFP unit including sensor pick-up relay, and circuit protection device operation.

D. Monitor Panel

1. Provide monitor panel capable of indicating relay operation and provide means for testing system with or without interruption of service. Construct so GF system cannot be left in an inactive or OFF state. Provide indicator lamps and TEST and RESET control switches.

PART 3 - EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with other work as necessary to interface installation of overcurrent protective devices with other work.

C. Provide a breaker coordination study. Set field-adjustable circuit breakers for trip settings recommended in study, subsequent to installation of devices.

D. Install fuses in overcurrent protective devices.

E. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.

F. Provide selective coordination of all breakers per NEC 700.27 and 701.27 Using the definition in Article 100 (NEC2014).

3.2 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

3.3 PHASE FAILURE EQUIPMENT

A. The contractor shall have the factory representative field test the phase failure equipment by assimilating a phase failure, reversing condition to test this equipment. If it does not operate correctly, make appropriate repairs. Condition of operation shall be reported in writing to the architect in triplicate.

END OF SECTION 262910

SECTION 262913 - ENCLOSED CONTROLLERS AND STARTERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of motor starter work is indicated by drawings and schedules.

B. Types of motor starter in this section include the following:

1. AC Fraction horsepower Manual Starters
2. AC Line Voltage Manual Starters
3. AC Non-Reversing Magnetic Starters
4. AC Combination Non-Reversing Magnetic Starters

1.2 QUALITY ASSURANCE

A. Comply with NEC and NEMA Standards as applicable to wiring methods, construction, and installation of motor starters. Comply with applicable requirements of UL 508, "Electric Industrial Control Equipment", pertaining to electrical motor starters. Provide units which have been UL-listed and labeled.

1.3 SUBMITTALS

A. Product Data: Submit dimensioned drawings of motor starters showing accurately scaled equipment layouts.

B. Motor Voltage/Current Report: After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage and amperage and thermal heater size installed for each motor.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):

1. Allen-Bradley Co. 1
2. Square D Co.
3. Eaton

2.2 MAINTENANCE STOCK, FUSES

A. For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed units, but not more than 5 units of each type, for both power and control circuit fuses.

2.3 MOTOR STARTERS

A. General: Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings, and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published information, and as required for complete installations.

B. Thermal Overload Units: Provide thermal overload units, sized in accordance with manufacturer's recommendations for full load current of motor controlled. Provide thermal heater units, sized to actual running full load current if actual full load current is less than 90% of motor nameplate full load current. Size heater for mechanical equipment after air and water balancing have been completed. Spare parts: Provide a spare set of each type and/or size.

C. AC Fractional Hp Manual Starters (Equal to Square D Class 2510): Provide manual, single-phase, 1 and 2 pole, 300 volt AC max, fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with one piece thermal overload relay with field adjustment capability of plus or minus 10% of nominal overload heater rating; for protection of AC motors of 1 HP and less. (For manually controlled motors in excess of 1 HP, see Line Voltage Manual Starters specified herein.) Provide starter with quick-make, quick-break trip free toggle mechanisms, green pilot lights, and with lock-off toggle operated handle. Mount surface units in NEMA 1 enclosures, unless noted otherwise. Provide flush mounted units with coverplate to match wiring device coverplates.

D. AC Line Voltage Manual Starters (Equal to Square D Class 2510): Provide line voltage manual starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt AC max; equip with pushbutton operator, low voltage protection feature, and green pilot light. Provide starters with trip free mechanism such that contacts will open under load and remain open until thermal element has cooled, and unit is reset. Mount surface units in NEMA 1 enclosure, unless noted otherwise. Provide overlapping trim for flush mounted units.

E. AC Non-Reversing Magnetic Starters (Equal to Square D Class 8536): Provide line voltage magnetic starters (nothing smaller than size 1 - typical all arrangements), to types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt max, 120 volt control voltage with solid state current sensing protection with under voltage trip in all phases. Equip units with holding contact, 2 normally open, and 2 normally closed auxiliary contacts, unless noted otherwise. Provide fused control transformer in each starter. Mount hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide NEMA 1 enclosure unless noted otherwise. Equip all spare starters complete with items as specified herein.

F. Control Contactor (Equal to Square D Class 8903 Type PB): Provide line voltage Contactor of the size indicated on the plans, to types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt max, 120 volt control voltage or as noted. Equip units with holding contact, 1 normally open, and 1 normally closed auxiliary contacts, unless noted otherwise. Provide fuse control transformer in each Contactor. Mount a red pilot light, in face of enclosure. Provide NEMA 1 enclosure unless noted otherwise.

2.4 SOLID STATE OVERLOAD RELAY (Include as a part of all magnetic starters)

A. The overload relay shall be a solid-state current sensing device that is ambient insensitive. The overload relay shall incorporate phase unbalance, phase loss and overload protection. The overload relay shall have a 3:1 current adjustment range. A visible trip indication and a trip test function shall be included. An LED shall indicate power to the device and there shall be a lockable tamper guard to protect the dial adjustment. The device shall be a Square D Class 9065 or approved equal.

B. AC Combination Non-Reversing Breaker and Magnetic Starters (Equal To Square D Class 8538): Provide line voltage combination starters, of types, ratings and electrical characteristics and indicated for 8536; 2 or 3 pole, 600 volts max with non-reversing magnetic starters with solid state current sensing overload protection, as specified herein; in common cubicle or enclosure with motor circuit protector. (To include Solid State Overload Relay).

C. Provide instantaneous trip circuit breaker as indicated and adjust to comply with manufacturer's recommendations. Provide combination starters for individual mounting, or for group mounting in motor control center as indicated. Provide NEMA 1 enclosures unless otherwise indicated.

D. AC Combination Non-Reversing Fused Disconnect and Magnetic Starters (Equal To Square D Class 8539): Provide line voltage combination starters, of types, ratings, and electrical characteristics; 2 or 3 pole, 600 volt maximum with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with fusible disconnect switch. Provide quick-make, quick-break, visible blade disconnect switch. Provide 2, 3, and 4; and visible blade, automatic circuit interrupters with push-to-trip feature and separate fuse clips for larger NEMA sizes. Fuse all starters with dual-element (time-delay) fuses equal to Bussman FRN/FRS. Provide combination starters for individual mounting, or for group mounting in motor control centers as indicated. Provide NEMA 1 enclosures unless otherwise indicated. (To include Solid State Overload Relay).

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS

A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install fuses in fusible disconnects, if any.

3.2 ADJUST AND CLEAN

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

C. Each motor starter shall be equipped with lock out capabilities.

3.3 FIELD QUALITY CONTROL

A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 262913

SECTION 264313 - SURGE PROTECTION DEVICE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The contractor shall provide and install Surge Protection Device units as shown on the plans. The units shall be incorporated in the panels where indicated. **When incorporated in the branch panel the unit must have a by-pass** such that when maintenance is needed on the SPD unit the panel can remain operable.

B. In some cases the SPD unit is a stand-alone unit. The contractor shall adhere to the plans.

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of interior and exterior luminaire work is indicated by drawings and schedules.

B. The contractor shall provide the quantity of luminaires indicated on the plans. The drawn length (in standard increments) of the luminaire determines the quantity and the catalog number identifies the model or type. The catalog numbers have been carefully prepared to define the luminaire type but may not be completely accurate. At least four (4) days prior to bidding each manufacturer shall compare the catalog numbers shown with the description and requirements on the drawings and shall notify the Architect/Engineer of any discrepancies. Specifically included in the evaluation shall be the verifying of proper mounting kits or accessories to facilitate installation of the luminaire as shown at each location on the plans. No allowance or redress will be allowed for discrepancies that were not addressed to the indicated authorities for clarification prior to bidding. Reporting of ambiguities is the responsibility of the bidder.

C. On all pendant mounted luminaires, provide a second set of pendants, of a different length, as directed by the Architect/Engineer, to be used at their discretion. Provide and install at no additional charge to the project.

D. Types of light sources within the luminaires include the following:

1. LED

1.2 QUALITY ASSURANCE

A. Comply with NEC (Article 410), NEMA and ANSI 132.1 as applicable to installation and construction of luminaires. Provide UL listed and labeled luminaires for installation on this project.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on interior and exterior building luminaires. Submit the manufacturer’s data on ballasts supplied with luminaires.

B. Shop Drawings: Submit dimensioned drawings of luminaires and supplied ballasts. Submit luminaire shop drawings with ballasts in booklet form with separate sheet for each luminaire, assembled in "type" alphabetical order, with proposed luminaire/accessories clearly indicated on each sheet.

C. Submit manufacturer’s contact information for future LED module/driver replacement by owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following (for each luminaire):

1. LED lamps

2.2 INTERIOR LUMINAIRES

A. General: Provide luminaires, of sizes, types and ratings indicated. Luminaire shall be complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters and wiring. Label each luminaire with manufacturer's name and catalog number. Provide all enclosed luminaires with positive latch mechanisms, spring tension clips not acceptable. Provide all exterior luminaires with damp or wet location label as required by application.

B. Support Requirements: Provide all pendant and stem mounted luminaires with flexible ball joint hangers at all points of support. Equipment hooks used to hang luminaires shall be supplied with safety latches. Provide all detachable luminaire parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain or safety cable.

Each hanger point shall be capable of supporting four times the luminaire weight. Backing supports shall be installed above (or behind) sheetrock, plaster and similar ceiling and wall materials. All surface mounted ceiling luminaires shall be supported from a structural channel. See plans for additional details.

2.3 LED DRIVERS/LAMPS

A. 5-year warranty.

PART 3 - EXECUTION

3.1 INSTALLATION OF LUMINAIRES

A. Install luminaires at locations and heights indicated, in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC (Article 410), NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that luminaires fulfill requirements.

B. Coordinate with other work as appropriate to properly interface installation of luminaires. Consult architectural reflected ceiling plan for exact location of all luminaires.

C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of luminaires. Support all ceiling mounted luminaires from the building structure; independent of the ceiling system, unless noted. Support each recessed luminaire from the building structure with #12 ga. steel wire attached to each luminaire corner (in addition to supports normally provided for attachment to the ceiling system). Provide backing supports above (or behind) sheetrock, plaster and similar ceiling and wall materials. Support ceiling mounted outlet boxes independent of the raceway system, and capable of supporting 200 pounds. See plans for additional details.

D. Install emergency battery inside luminaire ballast channel with charging indicator light and test switch mounted on fixture end, or visible and accessible through lens. Wire so luminaire can be tested with lights on and lamps in normal mode are switched off with other lighting in area. Connect emergency battery to unswitched conductor.

E. Clean luminaires of dirt and debris upon completion of installation.

F. Protect installed luminaires from damage during remainder of construction period. Repair all nicks and scratches to appearance of original finish. If repair is not possible, replace damaged portion of luminaire.

3.2 FIELD QUALITY CONTROL

A. Upon complete installation of luminaires, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning luminaires on site, then reset to demonstrate compliance; otherwise remove and replace with new luminaires and proceed with retesting.

B. At the time of Substantial Completion, replace lamps in interior luminaires which are observed to be noticeably dimmed after the Contractor's use and testing, as judged by Architect/Engineer. In addition, furnish replacement lamps amounting to 15% (but not less than one lamp) of each type and size used (Max. 48 of any one type). Deliver replacement stock with letter of transmittal as directed to Owner's storage space.

C. Luminaires shall be aimed in accordance with a manufacturer’s field layout for maximum uniform coverage of the field.

D. Provide tight equipment grounding connections for each luminaire.

END OF SECTION 265100

SECTION 265200 - EMERGENCY LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install emergency batteries as described in Contract Documents at the designated locations.

B. The batteries shall be of the type, size, voltage, and wattage as noted on the drawings.

C. All fixtures noted with "**E**" in type number as well as others indicated by keynote #1 shall be circuited directly to a non-switched power source.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Batteries

1. General
   a. Batteries shall be long life nickel cadmium type or as noted
   b. Complete with charging indicator light and test switch.
   c. Factory-installed in luminaire, or capable of being field-installed to same standards.

2. Standard Linear Luminaires
   a. Shall operate one luminaire at approximately 1400 lumens for 90 minutes.
   b. Battery shall be capable of full recharge in 24 hours.

3. Recessed Downlight Luminaires
   a. Shall operate lamp(s) of luminaire for 90 minutes minimum.
   b. Components shall be easily accessible for maintenance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Emergency Batteries

1. General
   a. Wire so luminaire can be tested with lights on.
   b. Wire so lamps in normal mode are switched off with other luminaires in area. Connect unit to unswitched conductor of normal lighting circuit.

2. Recessed Downlight Luminaires: If indicator light and test switch cannot be installed within fixture, install on plate adjacent to luminaire.

3. Other Luminaires: Install batteries in driver channel of luminaire with charging indicator light and test switch mounted on luminaire end, or visible and accessible through lens.

END OF SECTION 265200

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The contractor shall provide and install the exterior luminaires as noted in the luminaire schedule on the plans and located as indicated. The contractor shall reference the architectural and landscaping plans and coordinate the conduit/conductor installation and light pole location therewith. If a discrepancy or conflict, refer same to the engineer for clarification.

B. The poles and luminaire provided and installed in this section shall include the ballast of the type noted in Section 265100, except temperature-rated shall be provided, or of the type as noted in the luminaire schedule on the plans.

C. The poles shall also include the required anchor bolts for mounting and a bolt cover plate.

D. The exterior luminaires being provided for this project shall be submitted for approval with those on Section 265100.

E. The conduit/conductor installation shall comply with the specification relating to the respective section, but the conductor size shall be taken from the plans and shall comply therewith.

F. The pole base shall be constructed of 5-bag concrete of the size, shape, and dimensions as noted on the plans. The contractor shall construct the base in strict accordance thereto, setting the anchor bolts to the pole base configuration. The exterior finish of the pole base shall be a sand hand-finished with all pits and voids filled, giving the base a quality appearance. After the pole has been set, the base shall be grouted, beveling the edges to drain water away from the anchor bolts. See Section 260529.

G. After the base concrete has reached 90% strength, set the pole on the base and plumb vertical, directing the luminaire as indicated on the plans.

H. Any and all scratches to the pole shall be finished to match the factory finish.

I. All pole bases shall be grounded with a No. 10 green ground that originates at the serving panel.

J. When the installation is complete, the luminaire must be clean and the area free of debris.

K. Provide an Aiming Diagram for all playing field luminaires and direct the luminaires as part of the Aiming Diagram.

1.2 EXECUTION

A. When complete the poles shall be adjusted to a vertical position, the anchor bolts tight and the cover plate set in place.

END OF SECTION 265600

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 260501 Common Electrical Requirements apply to work in this section.

C. Division-23 for location of equipment.

D. Section 260533 “Raceways for Electrical Systems” apply to work in this section.

1.2 SCOPE OF WORK

A. The Auxiliary Systems of this specification are sections that have numbers greater than 270000 and 280000. This specification will include the Auxiliary Sections that are relative to this project. (See Section 260000 for listing). The materials, equipment, apparatus, etc. noted in Division 26 relates directly to these sections and to be worked hand in hand with the components named in either or both. Examples: Conduit, Device boxes, support, etc. may be named in either or both specifications.

B. Each system mentioned herein is a complete system. Each network is a new system, an extension of an existing and/or a new system that incorporates an existing system into the new. Whatever the condition, the contractor shall provide all the equipment, materials, labor, etc. for a complete and operable network. Each system is specified to perform a definite function. The function and operation of a system is the final objective and whatever the requirement to accomplish that objective shall be included. If for any reason the specifications do not complete the network, the bidder and/or manufacturer’s representative shall call the deficiencies to the attention of the engineer by facsimile five (5) days prior to the bid date, so they can be included in an addendum. Failure to submit this information to the attention of the engineer does not relieve the bidder from supplying and installing the equipment needed for a complete and operable system.

C. Walk through the system when the project is complete and **each auxiliary system** shall be tested and set into operation.

D. The contractor, the owner's and manufacturer's representative shall test each component of each system, except for the Fire Alarm System where the local fire chief shall also witness the test, for normal operation. When the test is complete, the outcome of the test shall be reported in writing to the architect and engineer that the system meets all the conditions and functions of the specifications for normal operation. Each person in the test party shall place his signature on the report.

E. Example: In the case of the Fire Detection and Alarm System, the people mentioned above plus the local Fire Marshall (or his representative) shall check out the Fire Alarm System. Each component (break glass station, heat detector, ionization detector, alarms, etc.) shall be tested individually to prove their function in the total system. Any and all defective components shall be repaired and/or replaced.

F. Each of the other auxiliary systems, one by one (sound, F.A., telephone, computer, etc.) shall be tested and written reports made on the results of the test, as stated above with copies sent to the engineer and placed in each maintenance manual.

G. Return visits for sound and telephone systems: **One, six,** and **eleven months** after the system has been accepted by the owner, the factory representative shall return to the project and check-out the system to determine the condition of operation, answer any questions of the operator and/or administrator, make repairs, etc., to determine if the system is operating to its full potential.

H. The factory representative shall review with the operator and administrator on their use of the equipment making sure the equipment is used to the ultimate.

I. As heretofore mentioned in this specification each auxiliary system carries a one year warranty from the date of acceptance by the owner.

END OF SECTION 270000-280000

SECTION 270500 - TELEPHONE CONDUIT AND BOXES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide and install all the conduit, boxes, fittings, supports, etc. required for the system. See section 260533-2.1-G (2) for telephone conduit requirements.

B. The extent of the telephone system is to provide and install conduit from the point of service to the indicated outlets. Terminate the conduits in a standard device box, set at the indicated location and height. When complete install a nylon pull cord in the conduit for use of the cable installers.

C. Refer to the section 260533 and 260534 for requirements for conduit, fittings, device boxes, cover plates, etc. as applicable. The conduit installation shall comply with Section 260533 with supports as indicated.

D. Empty conduits shall include a nylon pull cord with a 24” pigtail at each end.

E. The owner shall provide and install the telephone system.

END OF SECTION 270500

SECTION 271000 - DATA CONDUIT AND BOXES (CONDUIT ONLY)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Section 260501 “Common Electrical Requirements” applies to work in this section.

C. Section 260533 “Raceways for Electrical Systems” applies to work in this section.

1.2 DESCRIPTION OF WORK

A. Provide and install all the conduit, boxes, fittings, support etc. required for this system. See section 260533 - 2.1 - G (2) for data conduit requirements.

B. Install conduit as required, 1¼" minimum size, for the installation of a computer system as per the drawings. The equipment shall be by others. Coordinate rough-in with the equipment supplier.

C. Where computer conduit is indicated for cabinet mounting, refer to the detail on the drawings. EMT conduit, boxes, fitting, etc. shall be fabricated and installed in the cabinet. The height shall be below the countertop and the plugs made accessible through holes in the counter top.

D. The owner shall provide and install the computer system.

E. Raceways, Hangers, etc.

END OF SECTION 271000

SECTION 283123 - FIRE DETECTION AND ALARM SYSTEM

PART 1-GENERAL

A. The contractor shall provide and install an addressable Fire Alarm system in this facility as specified herein and shown on the plans. The system shall be complete, operable, and receive acceptance (in writing) from the governing authority.

B. The installation includes all the conduit, boxes, fittings, etc. as required for a complete and operable system.

1.1. GENERAL REQUIREMENTS

A. The requirements of the Contract Documents, including the General and Supplementary General Condition and Division 1 - General Requirements shall apply to the work of this section.

B. Scope

1. The work covered by this Section of the Specification shall include all labor, equipment, materials, and services to furnish and install a complete fire alarm system of the addressable, analog non-coded general alarm type. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer. The system shall consist of, but not be limited to, the following:
   a. Fire alarm control panel
   b. Remote Annunciator.
   c. Addressable manual fire alarm stations.
   d. Addressable analog smoke detectors.
   e. Conventional Beam detectors.
   f. Addressable analog and conventional duct smoke detectors.
   g. Addressable analog and conventional heat detectors.
   h. Sprinkler waterflow alarm switches.
   i. Audible notification appliances; bells, horns, chimes.
   j. Visual notification appliances; strobes.
   k. Central station alarm connection control.
   l. Air handling systems shutdown control.
   m. Smoke exhaust systems startup control.
   n. Voice Annunciation - Where required by occupancy.
   o. Magnetic door holder release.
   p. Dry pipe sprinkler release valve/deluge valve control.
   q. Sprinkler supervisory switches and tamper switch supervision.
   r. Dry pipe sprinkler release valve/deluge valve supervision.
   s. Emergency generator supervision.
   t. Fire pump supervision.
   u. Battery Standy.
   v. Provide three (3) spare smoke detectors and one (1) heat detector (deliver to owner). See section 260501-2.4E
   w. Fire alarm system map.

C. Applicable Codes and Standards

1. All equipment shall be U.L. listed for its intended use.
2. NFPA Standards 72
3. The National Electric Code.
4. All other local codes and authorities having jurisdiction.

D. Related Documents

1. Secure permits and approvals prior to installation.
2. Prior to commencement and after completion of work notify Authorities having Jurisdiction.
3. Submit letter of approval for installation before requesting acceptance of system.

E. Related Work

1. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:
    a. Sprinkler waterflow and valve position supervisory switches shall be furnished and installed by the plumbing contractor but wired and connected by the electrical contractor.
    b. HVAC duct smoke detectors shall be furnished and installed by Division 23 but wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors. Provide a monitor module per duct detector and a control module for each HVAC unit for fire alarm shut down.
    c. Air handling and smoke exhaust system fan control circuits and status contacts to be furnished by the HVAC control equipment.
    d. Conduit: Section 260533.
    e. Wire and Cables: Section 260519.

2. Selection of a central station agency, its equipment, its fees and fees for leased telephone lines are the responsibility of the owner or his representative.

F. Submittals:

1. With the shop drawings, provide list of all types of equipment and components provided.
2. Provide description of operation of the system, similar to the provided in Part 2 of this Section of the Specification, to include any and all exceptions, variances or substitutions listed at the time of bid. Any such exceptions, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.
3. Provide manufacturer's printed product data, catalog cuts and description of any special installation procedures.
4. Provide samples of various items when requested.
5. Provide shop drawings as follows:
    a. Drawing of the fire alarm control panel.
    b. Drawing of the remote annunciator.
    c. Single line riser diagram showing all equipment and type, number, and size of all conductors.

G. Warranty

1. Manufacturer shall guarantee the system equipment for a period of one (1) year from date of final acceptance of the system. Equipment shall be guaranteed for two (2) years.
2. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.
3. Upon completion of the installation of fire alarm system equipment, the electrical contractor shall provide to the architect a signed written statement, substantially in form as follows: “The undersigned, having engaged as the Electrical Contractor o the (Name of Project) confirms that the fire alarm system equipment was installed in accordance with the wiring diagrams, instructions and directions provided to us by the manufacturer.”

H. Manufacturers: This specification has been written around Edward Systems Technology Fire Alarm equipment; equals of Notifier, Auto Call, Game Well, or an approved equal, may be accepted provided it meets all of the conditions and criteria outlined herein.

PART 2 - PRODUCTS

2.1. CIRCUITING GUIDELINES

A. Each addressable analog loop shall be circuited as shown on the drawings, but device loading is not to exceed 80% of loop capacity in order to leave for space for future devices. The loop shall have Class B operation.

B. Where it is necessary to interface conventional initiating devices provide intelligent input modules to supervise zone wiring.

C. Each of the following types of devices or equipment shall be provided with supervised circuits as shown on the drawings but shall be typically as follows:

1. Sprinkler valve supervisory switches: Provide one (1) supervisory module circuit for each sprinkler valve supervisory switch or floor.
2. Emergency generator: provide one (1) supervisory module circuits: one (1) for “Emergency Generator”.
3. Dry pipe/deluge sprinkler release valves: Provide one (1) releasing module circuit for each dry pipe/deluge sprinkler release valve.
4. Computer room smoke alarm control panels: Provide one (1) alarm module circuit for each computer room smoke alarm control panel.

D. Each of the following types of alarm notification appliances shall be circuited as shown on the drawings but shall be typically as follows:

1. Audible signals: provide one (1) notification appliance circuit for each twelve (12) alarm bells, horn strobes, horns, and chimes.

E. Each of the following types of remote equipment associated with the fire alarm system shall be provided with a form ‘C’ control relay contact as shown on the drawings, but shall be typically as follows:

1. HVAC fan systems: Provide one (1) shutdown addressable control relay contact for each HVAC fan system.

2. HVAC supply fans: Provide one (1) shutdown addressable control relay contact for each HVAC supply fan.
3. HVAC return fans: Provide one (1) shutdown addressable control relay contact for each HVAC return fan.
4. HVAC exhaust systems: Provide one (1) shutdown addressable control relay contact for each HVAC exhaust fan as required.

2.2. FIRE ALARM SYSTEM SEQUENCE OF OPERATION

A. The system shall identify any off normal condition and log each condition into the system database as an event.

1. The system shall automatically display on the control panel Liquid Crystal Display the first event of the highest priority by type. The priorities and types shall be alarm, supervisory, trouble, and monitor.
2. The system shall have a Queue operation and shall not require event acknowledgment by the system operator. The system shall have a labeled color-coded indicator for each type of event; alarm-red, supervisory - yellow, trouble-yellow, monitor - green which shall turn on when active events exist.
3. For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred and up to a 40-character custom user description.
4. The user shall be able to silence the local signal and review each event by simply selecting scrolling keys (up-down) for each event type.
5. New supervisory or trouble events shall sound a silence-able signal at the control panel.

B. Operation of any Alarm initiating device shall automatically:

1. Update the control/display as described above (A.1).
2. Sound all alarm signals throughout the building at the evacuation rate.
3. Turn on all strobe lights throughout the building.
4. Turn on a red alarm zone LED at the fire alarm control panel.
5. Operate the alarm relay contacts to initiate the transmission of an alarm to a central station agency via telephone dialer or on leased telephone lines.
6. Operate addressable control relay contacts to shut down all HVAC units serving floor of alarm.
7. Operate control relay contacts to return all elevators that serve the floor of alarm initiation to the ground floor. If the alarm originates from the ground floor, operate control circuits contacts to return all elevators to the floor above or to a level as directed by the local fire department.
8. Operate control relay contacts to release all magnetically held smoke doors throughout the building.
9. Visually annunciate the zone of alarm on the remote annunciator panel. The visual indication shall remain on until the alarm condition is reset to normal.
10. Activate voice annunciation in required spaces based on occupancy.

C. Activation of a sprinkler supervisory initiating device shall:

1. Update the control/display as described above and turn on the trouble relay.
2. Turn on a yellow zone LED at the fire alarm control panel.
3. Operate the supervisory relay contacts to initiate the transmission of an alarm to a central station agency via leased telephone lines.
4. Visually annunciate the zone of alarm on the remote annunciator panel. The visual indication shall remain on until the alarm condition is reset to normal.

D. The entire fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens, grounds or disarrangement of system wiring and shorts across alarm bell/strobe wiring shall automatically.

1. Update the control/display as described above (B.1).
2. Operate the supervisory relay contracts to initiate the transmission of an alarm to a central station agency via leased telephone lines.
3. Visually and audibly annunciate a general trouble condition, on the remote annunciator panel. The visual indication shall remain on until the trouble condition is repaired.

E. Support for Installer and Owner Maintenance

1. Provide a coded one man walk test feature. Allow audible or silent testing. Signal alarms and troubles during test. Allow receipt of alarms and programmed operations for alarms from areas not under test.
2. Provide internal system diagnostics and maintenance user interface controls to display/report the power, communication, and general status of specific panel components, detectors, and modules.
3. Provide loop controller diagnostics to identify common alarm, trouble, ground fault, Class A fault, and map faults. Map faults include wire changes, device type changes by location, device additions/deletions and conventional open, short, and ground conditions. Ground faults on the circuit wiring of remote module shall be identified by device address.
4. Allow the user to display/report the condition of addressable analog detectors. Include device address, device type, percent obscuration, and maintenance indicator. The maintenance indicator shall provide the user with a measure of contamination of a device upon which cleaning decisions can confidently be made.
5. Allow the user to report history for alarm, supervisory, monitor, trouble, smoke verification, and restore activity. Include Facility Name, Licensee, Project Program Compilation date, Compiler Version, Project Revision Number, and the time and date of the History Report.
6. Allow the user to disable/enable devices, zones, actions, timers, and sequences. Protect the disable function with a password.
7. Allow the user to activate/restore outputs, actions, and sequences.
8. Allow the service user to enter time and date, reconfigure an external port for download programming, initiate auto programming and change passwords. Protect these functions with a password.

F. Materials:

1. Fire Alarm Control Panel:
   a. The fire alarm control panels shall be Edwards Systems Technology (EST) type EST2 series and shall incorporate all control electronics, relays, and necessary modules and components in a semi-flush mounted cabinet. The operating controls and zone/supervisory indicators shall be located behind locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified. The cabinet shall be steel, with a gray finish. The assembly shall contain a base panel, system power supply and battery charger with optional modules suitable to meet the requirements of these specifications.
   Manufacturers: This specification has been written around Edwards Systems Technology, which establishes a standard.
   b. System circuits shall be configured as follow: Addressable analog loops Class A; Notification Appliance Circuits Class A.
   c. Single stage operation.

d. The system shall be supervised, site programmable, and of modular design with expansion modules to serve up to 192 detectors and 188 remote modules, and multiple notification appliance circuits (NACs) convertible to power risers to serve remote multiple NAC modules for zoned signal applications. The system shall be expandable to a minimum of 960 detectors and 940 remote modules.
e. The system shall store all basic system functionality and job specific data in non-volatile memory. The system shall survive a complete power failure intact.
f. The system shall have built-in automatic system programming to automatically address and map all system devices and provide a minimum default single stage alarm system operation with support of alarm silence, trouble silence, drill, lamp test, and reset common controls.
g. The system shall allow downloading of a job specific custom program created by system application software. It shall support programming of any input point to any output point. The system shall support the use of Bar Code readers to assist custom programming functions. It shall allow authorized customization of fundamental system operations using initiating events to start actions, timers, sequences, and logical algorithms.
h. The system shall support distributed processor intelligent detectors with the following operational attributes; integral multiple differential sensors, automatic device mapping, electronic addressing, environmental compensation, pre-alarm, dirty detector identification, automatic day/night sensitivity adjustment, dual normal/alarm LEDs, relay bases, and isolator bases.
i. The system shall use full digital communications to supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of "same type" devices without the need of addressing and impose the "location" parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.
j. The system shall have a U.L. Listed Detector Sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4 hours.
k. The system shall support 100% of all remote devices in alarm and provide support for a 100% compliment of detector isolator bases.
l. All panel modules shall be supervised for placement and return trouble if damaged or removed.
m. The system shall have a CPU watchdog circuit to initiate trouble should the CPU fail.
n. The system evacuation signal rate shall be March time at 120 PPM.
o. Provide a signal silence inhibit feature set to enter integer time between 0-99 minutes and an automatic signal silence timer set to enter integer time between 0-99 minutes. Audible notification appliances shall be affected by signal silence features. Visual signal appliance shall not be affected by signal silence features.
p. The system program shall meet the requirements of this project, current codes, and standards, and satisfy the local Authority having Jurisdiction.
q. Passwords shall protect any changes to system operations.
r. The power supply shall be a high efficiency switch mode type with line monitoring to automatically switch to batteries for power failure or brown out conditions. The automatic battery charger shall have low battery discharge protection. All outputs shall be power limited. The battery shall be sized to support the system for 24 hours of supervisory and trouble signal current plus general alarm for 5 minutes.

s. The LCD Display Module shall be membrane style construction with a 4 line by 20- character Liquid Crystal Display. The LCD shall use supertwist technology and backlighting for high contrast visual clarity. In the normal mode display the time, the total number of active events and the total number of disable points. In the alarm mode display space for user custom messages. The module shall have visual indicators for the following common control functions; AC Power, alarm, supervisory, monitor, trouble, disable, ground fault, cpu fail, and test. There shall be common control keys and visual indicators for; reset, alarm, silence, trouble silence, drill, and one custom programmable key/indicator. Provide four pairs of display control keys for selection of event display by type (alarm, supervisory, monitor and trouble) and forward/backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicators to flash the indicators when undisplayed events are available for display and turn on steady when all events have been displayed. Allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". Provide system function keys; status, reports, enable, disable, activate, restore, program, and test. The module shall have a numeric keypad, zero through nine with delete and enter keys.

t. The Main Controller Module shall control and monitor all local or remote peripherals. It shall support the LCD Display Module, power supply, remote LCD and zone display annunciators, strip and carriage printers, and support communication interface standard protocol (CSI) devices such as color computer annunciators and color graphic displays. The RS-485 port shall be capable of supporting up to 32 remote annunciators. The MCM shall provide one loop controller circuit, two notification appliance circuits, and common form 'C' contacts for alarm, supervisory, and trouble. Contact ratings shall be 1 Amp at 24Vdc.

u. The panel shall have:
   1) A march time module for signal rate control to provide 20 spm, 120 spm, or temporal 3-3-3 signal patterns.
   2) An interface module for remote site monitoring. The module shall have a local energy municipal look and reverse polarity connections for each of alarm, supervisory and trouble.

v. The Fire Alarm Contractor shall provide and install a laminated 1/16" building plan in a frame at the main Fire Alarm Panel and the Annunciator Panel showing the building zones. The plan shall have a red LED light therein indicating that will illuminate when an alarm is activated in that zone. The lamp will remain illuminated until the alarm has been cleared.

w. The system shall support and relate to an Annunciator Panel all the functions that are pertinent to a fireman as he visits the Annunciator Panel on a fire alarm. The panel shall be located at the designated entrance and shall be electrically called thereto.

2.3. SIGNATURE SERIES INTELLIGENT ADDRESSABLE ANALOG DEVICES

A. General, All Devices

1. Furnish and install where indicated on the plans.

2. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, number of alarms and troubles, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
3. Dependent on its functionally each device shall be capable of monitoring up to 32 diagnostic codes. This data shall be stored at the device and available for system maintenance.
4. Each device shall be capable of performing its intended function independent of the control panel to lower loop data traffic. Each device shall immediately alert the loop controller of a status change to achieve a loop response time of less than 500 ms.
5. Each device shall be capable of performing its intended function independent of the control panel to lower loop data traffic. Each device shall immediately alert the loop controller of a status change to achieve a loop response time of less than 500 ms.
6. The operating environment shall be restricted to a temperature of 32º F to 100º F, humidity: 0-93% RH, non-condensing.

B. Detector Devices General

1. Each detector shall continually monitor the environmental impact of temperature, humidity, barometric pressure and air-born contaminates. The process shall adapt the detector to long term environmental changes and signal the loop controller when the detector approaches 50% and 100% of the allowable environmental compensation value.
2. Differential sensing algorithms shall maintain a constant sensitivity setting between the alarm threshold and a compensated base line sensitivity setting between the alarm threshold and a compensated base line sensitivity. The base line sensitivity shall be updated approximately once every hour.
3. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication. A red LED shall flash to display alarm status. LEDs shall be visible through a full 360º viewing angle.
4. Each detector shall be capable of transmitting pre-alarm and alarm signals.
5. Each detector shall be suitable for mounting on Signature Series detector mounting base.
6. All detectors shall be suitable for wall mount applications.

C. Sensor Devices

1. Each detector sensor shall use differential sensing to provide accurate data to the detector's alarm algorithm processor. The fire decision algorithm shall combine all sensor analog signal dimensions and time to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. The detector shall respond faster to fire signal patterns affecting more than one sensor. Signal patterns not typical of fires shall be eliminated. Devices not capable of combining different fire parameters shall not be acceptable.
2. Sensor devices shall be:
    a. SIGA-PS Intelligent Photo Detector shall use a light scattering type photo sensor. The detector shall be suitable for area protection and direct insertion into air ducts up to 3' high and 3' wide with air velocities up to 5000'/min. without requiring specific duct detector housings or supply tubes. The detector shall have a UL Smoke Sensitivity Range 0.67 - 3.77% Obscuration/ft. The detector shall be rated for ceiling installation at a minimum of 30' centers.

b. Single Sensor Devices shall be:
    1) SIGA-HRS Fixed Temperature/Rate-of-Rise Heat Detector shall have a low mass thermistor and operate at a nominal fixed temperature of 135º F and at a temperature rise at or exceeding 15º F per minute. It shall have a minimum linear space rating of 70’ centers.
    2) SIGA-HFS Intelligent Fixed Temperature Heat Detector shall have a low mass thermistor and operate at a fixed temperature of 135º F. It shall have a minimum linear space rating of 70’ centers.

D. Detector Bases

1. Detector bases shall mount to North American 1 gang, 3½" or 4" octagon boxes, and a 4 in² box. Removal of the respective detector shall not affect communications with other detectors. Terminal connections shall be made on the room side of the base. All detectors shall be compatible with any base.
    a. The SIGA-SB and SIGA-SB4 standard bases shall provide terminals to connect a SIGA-LED Remote Alarm Indicator.
    b. The SIGA-RB and SIGA-RB4 relay bases shall have a bi-stable relay with form ‘C’ contacts rated at 30 Vdc at 1.0A, supervised for position and tested on power up. The relay shall be controlled by its respective detector processor and in the event of a communication failure the operation of the relay shall not be affected. Upon removal of the detector the relay shall automatically de-energized.
    c. The SIGA-IB and SIGA-IB4 Isolator Base shall be controlled by its respective detector processor and operate within 23 msec. Of a short circuit condition on the data lines. An active isolator base shall continue to test for the short condition and automatically return to normal should the fault condition clear.

E. Duct Detectors

1. SIGA-DH Duct Detector Enclosure shall an assembly suitable for mounting a Signature Series Detector into a duct.

F. Modules General

1. It shall be possible to change the personality or function of a device.
2. All modules shall be gang mounted and complete with the necessary mounting hardware, cover plates, and end-of-line devices.
3. Input wiring shall be supervised for opens and grounds.
4. Output wiring shall be supervised for opens, shorts, and grounds.
5. Each module shall have a minimum of 2 diagnostic LEDs. A green LED shall flash to confirm communications. A red LED shall flash to confirm active status.
6. SIGA-CT1 Single Input Module shall be of single gang construction and programmable.
7. SIGA-CT2 Dual Input Module shall be of single gang construction and each circuit shall be independently programmable.
8. SIGA-WTM Waterflow/Supervisory Input Module shall be of single gang construction and have two factory programmed circuits. Circuit one shall have personality code 2 (delayed waterflow) and circuit two shall have personality code 4 (latching supervisory).
9. SIGA-CC1 Single Input Signal Module shall be of two gang construction and have one signal riser input and one supervised Class ‘B’ output circuit rated a 24Vdc 2A or 50W. Programmed with personality code 5 it shall be capable of operating 24 Vdc polarized signals, or 25V or 70V speaker appliances.

10. SIGA-CC2 Dual Input Signal Module shall have two gang construction and provide two signal riser inputs and one Class 'B' supervised output circuit rated a 24Vdc 2A or 50W. It shall be capable of selecting one of two inputs (alert/page or evacuation) for operating 24 Vdc polarized signals, or 25V or 70V speaker appliances.
11. SIGA-CR Control Relay Module shall have single gang construction and provide one form 'C' dry relay contact rated 24Vdc at 2 amps. To control external appliances or equipment shutdown.
12. SIGA-UM Universal Class A/B Module shall have two gang construction and shall be configurable for a single riser input with a single output, single or dual inputs, or as a control relay. It shall be programmable.
13. SIGA-278 Intelligent Double Action Fire Alarm Station shall be of single gang construction and provide double action, single stage, non-coded, break glass operation. The fire alarm station shall be of lexan construction with an internal toggle switch. Provide a keyed locked test feature. Finish the station in red with white "LIFT THEN PULL HANDLE" and "PULL FOR FIRE" lettering.

2.4 FIRE ALARM NOTIFICATION APPLIANCES

A. General Notification Appliances

1. All appliances shall be U.L. Listed for Fire Protective Services.
2. All strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act Access abilities Guidelines (ADA(AG)), and shall be UL 1971, UL 1638, and ULC S526 Listed.

B. Furnish and install where shown on the plans:

1. Horns shall be manufactured by EST, Cat. No. 757 Series. In-Out Screw terminals shall be provided for wiring. A sound output level of 103 dBA Peak shall be provided.
2. Horn/Strobes shall be manufactured by EST, Cat. No. 757 Series. They shall provide synchronized flash strobe output, and 100 dBA Peak sound output level from the horn. Provide strobe outputs as indicated on drawing.
3. Mini-Horn/Strobes shall be manufactured by EST, Cat. No. 692 Series. They shall provide strobe output, and 91 dBA Peak sound level output from the horn. Provide strobe outputs as indicated on drawing.
4. Strobes shall be manufactured by EST, Cat. No. 202 Series. They shall provide synchronized flash output. Provide strobe outputs as indicated on drawing.

2.5 ANCILLARY DEVICES

A. Furnish and install where shown on the plans.

1. Furnish and install magnetic door holders, EST Cat. No. 1500 Series, for flush wall mounting as shown on the plans. The housings and contact plates shall have a brushed zinc finish. All units shall have a holding of force of approximately 25 lb. ft.

B. Acceptable Manufacturers:

1. The catalog numbers used are those of Edwards Systems Technology (EST), and constitute the type and quality of equipment to be furnished.

2. Approved Bidders:
   -Auto-Call, Gamewell and Notifier.
   -Other manufactures/bidders must submit products for approval at least 10 working days prior to bid date. Approved suppliers shall be required to meet all requirements of the specification.

PART 3 - EXECUTION

A. INSTALLATION:

1. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets, and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the manufacturer, approved by the local Fire Department, and shall be installed in red EMT conduit throughout. (Section 260533 - 2.1 - G (2))
2. All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.
3. End of Line Resistors: Shall be furnished as required for mounting as directed by the manufacturer.
4. All wiring shall be color coded throughout, to National Electrical Code standards.
5. The system shall be arranged to receive power from one three wire 120 VAC, 15 A supply. All low voltage operation shall be provided from the fire alarm control panel.
6. Field Quality Control: The system shall be installed and fully tested under the supervision of a trained manufacturer's representative. The system shall be demonstrated to perform all of the function as specified.

B. Tests

1. Reports of any field-testing during installation shall be forwarded to the Engineer in writing.
2. In the presence of the code enforcing authority, each individual component in the system shall be tested for operation on a circuit-by-circuit basis shall be tested for its complete operation. The procedure for testing the entire fire alarm system shall be set forth with the consent of the code enforcement official, the contractor, the school official, and the manufacturer representative. When complete, a statement of approval shall be written and signed by each of the testing parties, confirming acceptance shall be sent to the engineer, owner, and general contractor.

C. Documentation and Training

1. The contractor shall compile and provide to the owners three (3) complete manual on the completed system to include operating and maintenance instruction, catalog cuts of all equipment and components, as-built wiring diagrams and a manufacturer's suggested spare parts list.
2. In addition to the above manuals, the contractor shall provide the services of the manufacturer's trained representative for a period of four (4) hours to instruct the owners designated personnel on the operation and maintenance of the entire system. An EST2 End-User Training Video shall be included as part of the system documentation.

END OF SECTION 283123

SECTION 323116 - WELDED WIRE FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metallic-coated-steel, welded-wire fences.
2. Swing gates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading: Comply with ASCE/SEI 7 requirements for fence height, wind exposure category, design wind speed, and design wind pressure.

2.2 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Metallic-Coated-Steel, Welded-Wire Fences:

B. Fence Fabric: Metallic-coated-steel wire.

1. Spacing of Vertical Wires: 2 inches
2. Vertical Wire Size: 0.192 inch
3. Spacing of Horizontal Wires: 2 inches
4. Horizontal Wire Size: 0.225 inch

C. Posts:

1. Line Posts: Square tubes 3 by 3 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from [0.060-inch (1.52-mm)] [0.075-inch (1.90-mm)] [0.105-inch (2.66-mm)] nominal-thickness steel sheet and hot-dip galvanized after fabrication.
2. End and Corner Posts: Square tubes 3 by 3 inches formed from 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.

D. Post Caps: Formed from steel sheet and hot-dip galvanized after forming

E. Rails: Rectangular tubes.

1. Size: 1-1/2 by 1-1/2 inches
2. Metal and Thickness: 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.

2.3 SWING GATES

A. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 2-1/2 by 2-1/2 inches 0.105-inch (2.66-mm) nominal-thickness steel sheet and hot-dip galvanized after fabrication.

B. Metallic-Coated-Steel Finish: Galvanized finish.

2.4 FENCE AND GATE MATERIALS

A. Metallic-Coated-Steel Wire: Welded-wire fence fabric, hot-dip galvanized after fabrication. Weight of zinc coating shall be not less than 1.0 oz./sq. ft. (305 g/sq. m).

B. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade G60coating.

C. Galvanizing: For components indicated to be galvanized and for which galvanized coating is unspecified, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

2.5 MISCELLANEOUS MATERIALS

A. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size[or dry, packaged, normal-weight concrete mix complying with ASTM C387/C387M mixed with potable water according to manufacturer's written instructions].

2.6 METALLIC-COATED-STEEL FINISHES

A. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

B. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a [zinc-phosphate]conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.

PART 3 - EXECUTION

3.1 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels]to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1.2 m).

D. Post Setting: Set posts in concrete undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
4. Space posts uniformly at 6 feet o.c.

3.2 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means.

Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

B. instructions for grounding of electric-powered motors, controls, and other devices.

END OF SECTION 323116