Skagit County Courthouse Rooftop Jail Removal

205 W. Kincaid Street
Mount Vernon, WA 98273

ALLANA BUICK & BERS
Building solutions.
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Project Specifications Manual

SKAGIT COUNTY COURTHOUSE JAIL REMOVAL

Skagit County Project #: 3809
ABB Project # 22-7763.01

September 25, 2023

Allana, Buick and Bers Inc. 300 Elliot Ave W Seattle, WA 98119 206-443-6499

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NOTICE OF CALL FOR BIDS

Skagit County Courthouse Rooftop Jail Removal

Courthouse, 205 W Kincaid Street, Mount Vernon, WA 98273
Administration Building, 700 S 2nd Street, Mount Vernon, WA 98273

NOTICE IS HEREBY GIVEN that sealed bids will be received on **December 5, 2023 until 11:00am** at the Skagit County Commissioners Administrative Building, 1800 Continental Place, Mount Vernon, Washington 98273. Bids must be received at the County Commissioners' Office *prior to the bid opening time*. Bid Proposals will be recorded as to time and date received and secured until the time set for the opening. All bids must be *plainly marked on the outside*:

Skagit County Courthouse Rooftop Jail Removal

OPENING OF THE BID PROPOSALS:

At 11:00am or as soon as possible thereafter on December 5th, 2023, Bid Proposals will be opened and publicly read aloud in the Commissioners Hearing Room #100, 1800 Continental Place, Mount Vernon, WA. 98273. This event will be televised for remote viewing on Skagit 21 or online at https://www.skagitcounty.net/Departments/TV21/main.htm.

ITEM FOR BID:
The primary objective of this project is to remove unused portions of the 4th floor reinforced concrete jail facility located on the roof of the 1924 Skagit County Courthouse. The Project consists of furnishing all labor, materials, and other incidentals to remove major portions of this rooftop jail structure. The primary objective of this Project is to reduce the seismic demands on the three floors of the working Courthouse below. The Project includes retention of the existing stair, elevator, and mechanical room equipment servicing the floors below. All existing roof assemblies and a Cooling Tower will be removed and replaced as part of the Work. As the Courthouse will be in use during the construction period, the existing cooling tower and select plumbing equipment in mechanical room shall remain operable during working hours of the Courthouse. Additionally, all work on project causing noise, odors or air-borne debris shall be performed only when the Courthouse is not in use.

CONSTRUCTION COST ESTIMATE:

The Owners estimate for the Project is $2,400,000.

BID DOCUMENTS:
Free-of-charge access to project bid documents (plans, specifications, addenda, and Bidders List) is provided to Prime Bidders, Subcontractors, and Vendors through Builders Exchange of Washington by going to **www.bxwa.com, and clicking on "Posted Projects", "Public works", and "Skagit County"** or calling (425) 258-1303. "Harvesting" (downloading, copying, and transmitting) of any project information and/or project documents for purposes of reselling and/or redistributing information by any other party is not allowed by BXWA.

Bidders shall register to be automatically notified of addenda and will need to periodically check the on-line plan room for addenda issued on this project.

BXWA is the official plan center for the project.

A pre-bid conference for prospective bidders will be held at the North Entry (parking lot side) of the Courthouse, 205 W Kincaid Street, Mount Vernon, WA. 98273, at 9:00 AM on October 18, 2023. Vendors are encouraged to attend and contact Skagit County Facilities Management if unavailable during the scheduled event. A summary of questions and answers will be shared as a bid addendum.

Questions regarding the project must be submitted to Petersen Lambert email: plambert@abbae.com. Questions must be received by November 15, 2023, 3:00pm. The County will provide a confirmation of the question(s) receipt within 48 hours; if a bidder does not receive such confirmation it is solely responsible to re-send the question(s). County's responses will be provided to all bidders by addendum with final no later than November 22, 2023. No oral responses from the Owner or its representatives may be relied upon by bidders.

The Successful Bidder will be required to furnish the necessary additional Bond(s) for the faithful performance of the Work, as prescribed in the Bidding Document.

CONTRACTOR REGISTRATION:

Pursuant to RCW 39.06, the Bidder shall be registered and licensed as required by the laws of the State of Washington, including but not limited to RCW 18.27. In order to perform public work, the successful Bidder and Subcontractors, prior to Contract award, shall hold or obtain such licenses and registrations as required by State Statutes and Codes, and Federal and local laws and regulations and a City of Mount Vernon business license.

BID SECURITY:

Certified check, bank cashier's check or bid bond congruent with the Form of Bid Bond as identified in the "Instructions to Bidders" is required to be submitted with each proposal, in the amount equal to five percent (5%) of the total basic bid plus additive alternate bids (if applicable). Make bid security payable to the Skagit County, a Municipal Corporation, furnish bond executed by a licensed bonding agency authorized to do business in the locality of the Project.

RIGHT TO ACCEPT OR REJECT:

The Owner shall reserve the right to reject any or all proposals and the right to waive any irregularities or informalities in any proposal, subject to the Laws of the State of Washington as pertinent to Public Works and congruent with requirements and policies of Skagit County, and as may be deemed in the best interest of the Owner. In particular, the Owner reserves the right to reject a proposal which is not accompanied by the required bid security or subcontractors listing as described heretofore, and incomplete or irregular proposals which may exclude any item(s) as may be required by the Bid Documents. NO PROPOSALS WILL BE ACCEPTED AFTER THE TIME SET FOR RECEIPT OF BID PROPOSALS.

Skagit County is an Equal Opportunity and Affirmative Action Employer.

Small, Minority and Women-Owned firms are encouraged to submit bids.

WITHDRAWAL OF BID:
No proposal may be withdrawn after the time set for the opening thereof, unless the Award of the Contract is delayed for a period of forty-five (45) calendar days.

NOTICE GIVEN BY ORDER OF THE BOARD OF COUNTY COMMISSIONERS THIS

_____day of _____2023.

_____

Clerk of the Board
Skagit County Commissioners

Published in the Skagit Valley Herald and Daily Commerce Journal: Sep 28 & Oct 5, 2023

END OF SECTION

SECTION 00 21 00

INSTRUCTION TO BIDDERS

A. EXAMINATION OF SITE AND CONSTRUCTION DOCUMENTS

1. Before submitting a proposal, the bidder shall:

   a. Carefully examine the drawings and specifications,

   b. Visit the site of the work,

   c. Fully inform itself of existing conditions and limitation, relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of its obligation to furnish all material and labor necessary to carry out the provisions of this contract.

   d. Rely entirely upon its own judgment in making its proposal,

   e. Include in its bid a sum sufficient to cover all items required by the contract including all labor, materials, and services necessary to complete this project.

B. ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the plans, specifications, or other pre-bid documents will be made to any bidder verbally. Every request for such interpretation should be in writing addressed to the Architect, and to be given consideration, must be received at least 7 days prior to date fixed for opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications. Failure of any bidder to receive addenda shall not relieve any such bidder from any obligation under its bid as submitted. All addenda so issued shall become part of the contract documents. Approval of requested substitutions or proposed equals will be by Addenda as above.

C. PRODUCT SUBSTITUTIONS

1. Substitutions: Bids must be based upon the specific articles and materials named in the Drawings and Specification. Substitution may be made only under the following conditions:

   a. Prior to Bid Opening: Not less than ten calendar days prior to bid opening, prime bidders may submit to the Architect written requests for approval of articles or materials, accompanied by complete descriptions, technical data and samples. Approval or rejection of the proposed substitutions will be made by addenda issued to all bidders. Submit material / product requests as specified in Section 01 60 00.

2. After Award of Contract: Approval of substitution will be made only in

exceptional cases where the Contractor submits satisfactory evidence to the Architect that through no fault of its own, specified or otherwise approved items cannot be obtained in time to avoid delay to the work. Approval in such cases shall conform to the other requirements above.

D. **INTERPRETATIONS AND CORRECTIONS TO BIDDING DOCUMENTS**

Bidders and Sub-bidders shall promptly notify the Architect of any ambiguity, inconsistency or error which they may discover upon examination of the Bidding Documents or of the site and local conditions. Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least three days prior to the date for receipt of Bids. Any interpretation, correction or change of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.

E. **FORM OF BID**

A Bid Form is attached to these Drawings and Specifications. Make Bid according to Form. Fill in all spaces. Bids shall not contain any recapitulation of work done. State numbers in writing and in figures. Completed form must be without interlineation, alteration or erasure. Signatures must be in longhand.

F. **POWER OF ATTORNEY**

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of the power of attorney.

G. **ORAL AND TELEPHONIC BIDS**

Oral and telephonic modifications of bids cannot be considered.

H. **SUBMISSION OF BID**

Enclose all items on Bid Submittal Checklist, Section 00 43 93, in opaque sealed envelope. Address to: Skagit County Board of Commissioners. Particulars are in the Advertisement for Bid. Deliver in person or by post. Bidder is responsible for delivery of bid at or before the time set for bid opening. The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. The Owner reserves the right to reject any bid of the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligation of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

I. **BID BOND**

Each bidder agrees to furnish a bid bond AIA Document A310 or a certified check amounting to five percent (5%) of the bid, included with its proposal. When left in escrow with the Owner its amount or penalty sum is the measure of damages which the

Owner will sustain by the failure of the bidder to execute the Form of Agreement and furnish a 100 percent Performance and Payment Bond, AIA Document A312, and if the bidder fails to deliver said documents within 10 days after written notice, notice of the award of the contract to him, then the check shall become the property of the Owner or the Bid Bond shall remain in full effect. But if the bid is not accepted within 45 days after the time set for opening bids, or if the bidder delivers said contract and the bonds, then the check shall be returned to him or the bid bond shall become void. The right is reserved to hold the bid bonds of the three lowest bidders until the award of the contract or for a period of 45 days, whichever is the shorter time. Bids of all unsuccessful bidders will be returned as soon as feasible after the bid opening.

J. **WITHDRAWAL OF BIDS**

Any bidder may withdraw its bid either personally or by written request at any time prior to the hour set for the bid opening. No bid may be withdrawn or modified after the time set for opening unless and until the award of the contract is delayed for period exceeding (45) forty-five days.

K. **TIME OF COMPLETION**

Bidder must agree to complete all work in 2024, Substantially Complete the Work within (120) one hundred twenty consecutive calendar days from the date of Commencement, and reach Final Completion of the Work within (30) sixty consecutive calendar days thereafter. Time is of the essence and contractor shall make every reasonable effort to adhere to the established schedule.

L. **SECURITY FOR FAITHFUL PERFORMANCE**

Simultaneously with its delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of the Contract and for payment of all persons performing labor under the Contract and furnishing material or services in connection with the Contract as described in the Contract Documents. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner, registered in the State of Washington, Insurance Commissioners Office. List Bonding Agent and address of same.

M. **CONTRACTOR'S AND SUBCONTRACTOR'S PUBLIC LIABILITY**

Vehicle Liability and Property Damage Insurance shall be furnished as required by the Supplementary General Conditions.

N. **BUILDER'S RISK INSURANCE**

Property Damage Insurance shall be as required by contract insurance requirements in Appendix F.

LAWS AND REGULATIONS, PREVAILING WAGES

The Bidder's attention is directed to the fact that all applicable State laws, municipal

ordinances, and rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they shall be deemed to be included in the Contract the same as though written out in full therein. All persons or firms performing on public service or construction contracts shall submit to the State, in advance of the work of all trades, a completed Form SF 9882, "Statement of Intent to Pay Prevailing Wages," accompanied by the filing fees for each Statement (Statements are available at Offices of Washington State Department of Labor and Industries). Refer to Supplementary General Conditions for Prevailing Wage information applicable to this project required by law.

O. **QUALIFICATIONS OF BIDDERS**

1. The Architect and / or the Owner may make such investigations as necessary to determine the ability of a Bidder to perform the work, and the Bidder shall furnish all such information and date as may be requested prior to bidding. The Owner reserves the right to reject any bid if the evidence submitted by, or if investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to perform the obligations of the Contract and to complete the work contemplated therein. Conditional Bids will not be accepted.

2. To enable the Owner to evaluate the competency and financial responsibility of a Contractor, when requested by the Owner, furnish the following information, which shall be sworn to under oath by him or by a properly authorized representative of the Bidder.

    a. The address and description of the Bidder's plan and place of business.

    b. The name and/or Articles of Co-Partnership or Incorporation.

    c. Itemized list of equipment available for use on the project.

    d. A certified or authenticated financial statement, dated within thirty (30) days prior to the opening of bids. The Owner may require that any items of such statements be further verified.

    e. A list of present contracts, including dollar values, percentage of completion and the names of all Owners involved.

    f. A statement regarding any past, present and pending litigation with an Owner.

    g. Such additional information as may be required that will satisfy the Owner that the Bidder is adequately prepared, in technical experience or otherwise, to fulfill the contract.

    h. Sufficient documentation to ensure that the Contractor is in compliance with the current Fair Employment Practice requirements of the Owner.

P. **Prior to award of Bid the Owner shall verify all items listed under Bidder's Responsibility Criteria. If criteria cannot be verified bidder will be deemed non-responsive.**

Q. **POST-BID INFORMATION**

1. The successful bidder shall submit to the Architect, within ten calendar days of the notifications of selection for award of the Contract, the following:

   a. Statement of Cost for each major item of work or subcontract included in the Bid, equaling the total Contract award, and such other data as are required by the General Conditions, including Article 5.2.

R. **LAWS AND REGULATIONS**

The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they shall be deemed to be included in the Contract the same as though written out in full therein. Bidders are advised that if successful, they will be required to meet all applicable federal, state, and local laws pertaining to permits, licenses, fees and taxes, as well as laws pertaining to employment and wages. Bidders are responsible for determining the extent and applicability of such laws.

S. **DEFINITIONS**

1. Bid Documents include the Instructions to Bidders, the Bid Form, and the contract Documents, including any Addenda.

2. Contract Documents consist of the Owner-contractor Agreement, the Conditions of the Contract (General, Supplementary, and other Conditions), the Drawings, the Specifications, and all Addenda issued prior to and all Modifications issued after the execution of the Contract.

3. Addenda are written or graphic instruments issued prior to the execution of the contract which modify or interpret the Bidding Documents, including the drawings and specifications, by addition, deletion, clarification, or correction. Addenda issued prior to the receipt of Bids will be mailed, faxed, or delivered to each person or firm recorded by the Engineer as having received the Bid Documents.

T. **AWARD OF THE CONTRACT(S) / REJECTION OF BIDS**

1. The Contract will be awarded to the responsible bidder(s) submitting the lowest proposal complying with the condition of the Advertisement for Bid and these contract documents provided the bid is reasonable and in the best interest of Skagit County. Items in this bid, approved for contract by the Board of Commissioners, shall be awarded by Skagit County.

2. Skagit County reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in the interest of the County. Skagit County reserve the right to select all or individual alternate bid items whichever is determined to be in the best interest of the County.

3. The bidder to whom the award is made will be notified at the earliest practicable date.

U. DISQUALIFICATION OF BIDDERS

1. Any one or more of the following causes may be considered sufficient for the disqualification of a Bidder and the rejection of its bid or bids:

   a. Evidence of collusion among Bidders.

   b. Lack of expertise as shown by past work and judged from the standpoint of workmanship and performance history.

   c. Uncompleted work under other contracts which, in the judgment of the Skagit County, might hinder or prevent the prompt completion of additional work if awarded.

   d. Being in arrears on existing contracts, in litigation with an Owner, or having defaulted on a previous contract.

   e. Delinquent taxes due to State and Federal Government including: B&O, L&I, payroll, social security and Medicare.

   f. Contractor's naming oneself as a Subcontractor for which they have no expertise and working knowledge directly within the firm.

   g. Federal or State debarment from contracts.

END OF SECTION

SECTION 00 31 00
INFORMATION AVAILABLE TO BIDDERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 REPORTS and EXISTING DRAWINGS

1. Refer to Appendices A, B and C for available existing Drawings
2. Refer to Appendix D for Seismic Evaluation
3. Refer to Appendix E for Asbestos and Lead Reports
4. Refer to Appendix F for Contract Terms and Templates

1.03 PURPOSE

A. Reports are for information and reference purposes only and do not contain Contract Work.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 00 41 00
BID FORM

Bidder's Firm Name: _____ Date: _____

Address: _____

_____

Telephone No.: _____

TO: Skagit County
Board of Commissioners
1800 Continental Place, Suite 100
Mount Vernon, WA 98273

Gentlemen and Ladies:

The undersigned having carefully examined the Bid Documents entitled "Skagit County Courthouse Rooftop Jail Removal", dated September 25, 2023 and having visited the site and examined the conditions affecting the Work, hereby submits the following proposal:

The Undersigned proposes to furnish all labor, materials, services, and incidentals to perform all work necessary for the completion of the Work described in the Call for Bids and associated specifications for the following Stipulated Sum for each bid item:

BASE BID:

The Bidder further proposes to accept as full payment for the work proposed herein the amounts computed under the provisions of the contract documents and based upon the bid price for fully completed work as included in the proposal and the Lump Sum Bid Price represents a true measure of the labor and materials required to perform the work, including all allowances for overhead and profit for each type of work called for in these contract documents.

The following prices shall include all materials, labor, tools, and equipment without sales tax where shown. The bidders shall include the cost of the mobilization and general conditions within each separate bid item. The amounts shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.

Bid Item: Skagit County Superior Court Rooftop Jailhouse Removal Base Bid

Rooftop Jailhouse Removal Base **$**_____

_____DOLLARS
(Please print dollar amount in words in space above for base bid not including sales tax.)

Alternate #1 Deductive: Contractor option to reduce bid amount in exchange for two weeks of unrestricted working hours to aid demolition and debris removal during which the County would not conduct business in the building.

Unlimited Access for 2 Weeks **$**_____

_____DOLLARS

(Please print dollar amount in words in space above for base bid not including sales tax.)

SALES TAX

The Undersigned certifies that the above-named construction costs do not include Washington State and Local Sales Taxes applicable to Skagit County as applied to materials and labor which will become a permanent part of the Work. All other Sales and Use Taxes properly levied by the State of Washington and Local Agencies on labor, materials, and equipment utilized on a temporary basis shall be included in the proposed amounts.

CONTRACT PROVISIONS

If the Undersigned is notified of the acceptance of this proposal within 45 days from the date set for the opening thereof, or at any time thereafter before this proposal is withdrawn, the undersigned agrees to execute a contract for the above Work for the above-named compensation in the required Form of Agreement containing the following provisions and to furnish the required bonds.

1. Time of Completion: The Undersigned agrees if awarded the Contract, to complete the project in 2024, be Substantially Complete within one hundred twenty (120) consecutive calendar days from date of Commencement and reach Final Completion of the Work within (30) thirty consecutive calendar days thereafter.

2. Liquidated Damages: The Undersigned agrees that time is of the essence of this Contract and acknowledges that the amounts of damages specified are a measure of the damages which the Owner will sustain should the Undersigned fail to complete the Work within the Contract Time. Liquidated damages shall be Five Hundred Dollars ($500.00) per calendar day for failure to substantially complete the work within the time specified and ($500.00) per day thereafter for each consecutive calendar day that final completion is delayed.

BID GUARANTEE

The Undersigned agrees that the check or bid bond accompanying this proposal which amount is not less than 5 percent of the bid proposed, is left in escrow with the Owner, that the amount of the check, or penal sum of the bond, is the measure of damages which the Owner will sustain by failure of the Undersigned to execute said Contract and furnish required bonds, and that if the Undersigned fails to deliver said documents within 10 days after receipt of notice of award to him, the check shall become the property of the Owner and the bond shall remain in full effect. But if this proposal is not accepted within 45 days after the time set for the opening of bids, then the check shall be returned and the bond shall become void.

NON-COLLUSION CERTIFICATE

The Undersigned, being duly sworn, deposes and says that the person, firm, associated, co-partnership or corporation herein named, has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in the preparation and submission of this proposal to the Skagit County Board of County Commissioners for consideration in the award of the contract.

ADDENDA

Receipt of Addenda numbered ___ ___ ___ is hereby acknowledged.

PREVAILING WAGES

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date September 25, 2023 the bidder is not a “willful” violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

I certify under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

_____
Bidder’s Business Name

_____
Signature of Authorized Official*

_____
Printed Name

_____
Title

_____ _____ _____
Date City State

Check One:

Sole Proprietorship ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

State of Incorporation, or if not a corporation, State where business entity was formed:

_____

If a co-partnership, give firm name under which business is transacted:

_____

** If a corporation, proposal must be executed in the corporate name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, proposal must be executed by a partner.*

Subscribed and sworn to before me this_____day of_____, 2023

_____
Notary Public in and for the State of
Washington, residing in
Washington.

END OF SECTION

SECTION 00 43 13
BID SECURITY FORM

PART 1 - GENERAL

A. The "Bid Bond", AIA Document A310, 2010 Edition, is a part of these Contract Documents and is incorporated as fully as if bound herein.

B. The Bid Bond Form may be obtained from the Architect's office, or from the American Institute of Architects, 1735 New York Avenue NW, Washington D.C. 20006 as follows:

1. https://aiacontracts.com

C. Contractor may use their standard bid security form as acceptable substitution.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 00 43 36
PROPOSED SUBCONTRACTOR FORM

Bidder's Name: _____ Date: _____

Project Name: _____

Named subcontractors must have a reputation of competency in their respective fields of work. Contractor assumes responsibility for quality of work performed by their selected subcontractors. If a category of work will not be subcontracted bidder must list themselves. Subcontractor listings shall be due no later than (1) one hour after bid opening.

Designated Work	**Firm Name**
1. Structural Steel:	
2. Roofing:	
3. Gypsum Board Assemblies:	
4. Plumbing:	
5. HVAC:	
6. Electrical:	
7. Other:	
8. Other:	

_____ _____
Bidder's Signature Date

END OF SECTION

SECTION 00 43 93
BID SUBMITTAL CHECKLIST

The bidder's attention is called to this list of submittals, which is provided for the convenience of the bidders. This checklist and does not include full details for submittals or bidder responsibilities that can be found in other sections of this project manual.

A. BID FORM: The bid prices must be shown in the spaces provided, and any addenda must be acknowledged on the Bid Form where space is provided. Filled in its entirety, signed by the bidder, and submitted at time of bid submission.

B. BID SECURITY FORM: This form is to be executed by the bidder and the surety company unless bid is accompanied by a certified check. The amount of this bond shall not be less than five percent (5%) of the total amount of the bid and may be shown in dollars or on a percentage basis. To be submitted with bid proposal.

C. BIDDERS' QUALIFICATIONS: To be filled out in its entirety and submitted with the bid form at time of bid submission.

D. BIDDERS' RESPONSIBILITY CRITERIA **SUBMIT WITH BID**: **There are numerous forms and information contained within this section. Special attention is called to the Bidder to fill out, sign and provide all forms and information requested at the time of bid submission.**

1. Documentation confirming Contractor has been in business at least 5 years in WA
2. Certification Regarding Debarment Suspension or Ineligibility
3. Supplemental Bidder Responsibility (notarized)
4. Copy of standard subcontract form for Owner review
5. A list of prevailing wage complaints filed against Contractor within 5 years
6. List of any willful and/or serious safety violations
7. Details on at least one project of similar size and scope completed within 5 years

E. SUBCONTRACTOR LISTING: Submit all subcontractors, and work categories listed on form attached, **within (1) one hour after specified time of bid opening.** Names of subcontractors performing structural steel installation and rebar installation may be submitted within 48 hours after bid opening.

The following forms are to be executed after the contract is awarded:

A. CONTRACT: This agreement to be signed by the successful bidder.

B. PERFORMANCE BOND: One hundred percent of the Contract Price to be executed by the successful bidder and their surety company. The surety on such bonds shall be a duly authorized surety company satisfactory of the Owner.

C. PAYMENT (LABOR MATERIALS AND TAXES) BOND: One hundred percent of the Contract Price to be executed by the successful bidder and their surety company. The surety on such bonds shall be a duly authorized surety company satisfactory of the Owner.

D. RETAINAGE INVESTMENT OPTION: This agreement to be executed by the successful bidder.

E. CONTRACTOR'S CERTIFICATION: Concerning Labor Standards and Prevailing Wage Requirements. Submit Statement of Intent to Pay Prevailing Wages. (Form F 700-029-000, available at Offices of Washington State Department of Labor and Industries).

END OF SECTION

SECTION 00 45 00
BIDDER'S QUALIFICATIONS

Each bidder submitting a proposal for this Project shall submit, as part of its bid, the following information:

1. Name of Bidder: _____

2. Business Address: _____

   _____

   _____

3. Telephone Number and Area Code: _____

4. IRS Federal Employer's Identification Number: _____

5. Current State Unified Business Identification Number: _____

6. Number of years engaged in the contraction business under the present firm name: _____

7. Total value of contracts in force: _____

8. General description of work for which Bidder is qualified: _____

   _____

   _____

   _____

9. Recent significant project completed by Bidder including owner's name, approximate cost, and completion date:

   1. _____

   2. _____

   3. _____

   4. _____

10. Major equipment owned by the Bidder:

    1. _____

    2. _____

    3. _____

    4. _____

11. Bank Reference: _____

    _____

    _____

12. Washington State Contractor Registration Number: _____

13. Bonding Reference: _____

    _____

    _____

14. Bonding Capacity: _____

Bidder:

By: _____ Title: _____ Date: _____

END OF SECTION

SECTION 00 45 49
BIDDER RESPONSIBILITY CRITERIA

Low Responsible Bidder

It is the intent of the Owner to award a contract to the low responsible bidder. In determining the bidder's responsibility, the Owner shall consider an overall accounting of the items listed below. The bidder must submit the following information, demonstrating that they meet the listed criteria:

1-02 Bid Procedures and Conditions

1-02.1 Qualifications of Bidder

A. Bidders must meet the minimum qualifications of RCW 39.04.350, as amended:

"Before award of a public works contract, a bidder must meet the following responsibility criteria to be considered a responsible bidder and qualified to be awarded a public works project. The bidder must:

(a) At the time of bid submittal, have a certificate of registration in compliance with chapter 18.27 RCW;

(b) Have a current State unified business identifier number;

(c) If applicable, have industrial insurance coverage for the bidder's employees working in Washington as required in Title 51 RCW; an employment security department number as required in Title 50 RCW; and a State excise tax registration number as required in Title 82 RCW; and

(d) Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).

(e) If bidding on a public works project subject to the apprenticeship utilization requirements in RCW 39.04.320, not have been found out of compliance by the Washington state apprenticeship and training council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under chapter 49.04 RCW for the one-year period immediately preceding the date of the bid solicitation; and

(f) Until December 31, 2019, not have violated RCW 39.04.370 more than one time as determined by the department of labor and industries.

B. In addition to the bidder responsibility criteria above, the bidder must also meet the following relevant supplemental bidder responsibility criteria applicable to the project:

a. The Bidder shall not currently be debarred or suspended by the Federal government. The Bidder shall not be listed as a current debarred or suspended bidder on the U.S. General Services Administration's "Excluded Parties List System" website. Bidder debarment or suspension status may be verified through

this website: http://www.epls.gov/. The Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is in compliance with this criteria.

b. The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue, without a payment plan approved by the Washington State Department of Revenue. The Bidder shall not be listed on the Washington State Department of Revenue's "Delinquent Taxpayer List", which may be verified at the following website: http://dor.wa.gov/content/fileandpataxes/latefiling/dtlwest.aspx. The Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

c. The Bidder shall not have been convicted of a crime involving bidding on a public works contract within five (5) years prior to the bid submittal deadline. The Bidder shall provide a duly executed sworn statement (on the included form, or on a form otherwise determined to be acceptable by the Owner), that the Bidder has not been convicted of a crime involving bidding on a public works contract. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

d. The Bidder's standard subcontract form shall include the subcontractor responsibility language required by RCW 39.06.020, and the Bidder shall have an established written procedure which the Bidder uses to validate the responsibility of each of its subcontractors. The Bidder's subcontract form shall also include a requirement that each of its subcontractors shall have and document a similar procedure to determine whether the sub-tier subcontractors with whom it contracts are also "responsible" contractors as defined per RCW 39.06.020. The Bidder shall submit a copy of its standard subcontract form for review by the Owner, a written description of the Bidder's procedure for validating the responsibility of the subcontractors with which the Bidder contracts, and a duly executed sworn statement (on the included form, or in a form otherwise determined to be acceptable by the Owner) that the Bidder has properly made a determination of responsibility for all subcontractors for the project. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

e. The Bidder shall not have a record of prevailing wage complaints filed against the Bidder within five (5) years prior to the bid submittal date that demonstrates a pattern of failing to pay workers prevailing wages, unless there are extenuating circumstances that are acceptable to the Owner. The Bidder shall submit a list of prevailing wage complaints filed against it within five (5) years of the bid submittal date along with a written explanation of each complaint, and how it was resolved. The Owner shall evaluate the explanations provided by the Bidder (and the resolution of each complaint) to determine whether the complaints demonstrate a

pattern of the Bidder failing to pay its workers prevailing wages as required. The Owner may also evaluate complaints filed within the time period specified that were not reported by the Bidder. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

f. The Bidder shall not have had any public works contract terminated for cause by a government agency during the five (5) year period immediately preceding the bid submittal deadline for the project, unless there are extenuating circumstances acceptable to the Owner. The Bidder shall provide a duly executed sworn statement (on the included form, or in a form otherwise determined to be acceptable by the Owner), that the Bidder has not had any public works contract terminated for cause by a government agency during the five (5) year period immediately preceding the bid submittal deadline for the project. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

g. The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects within three (3) years of the bid submittal date, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its subcontractors, suppliers, and workers, unless there are extenuating circumstances which are acceptable to the Owner. The Bidder shall submit a list of all public works projects that the Bidder has completed within the previous three (3) years prior to the bid submittal date, and include for each project the following information:

    i. The owner for each public works project, and contact information for each owner.

    ii. A list of claims filed against the retainage and/or payment bond(s) for each of the public works project.

    iii. A written explanation of the circumstances surrounding each claim against the retainage and/or payment bond(s), and an explanation as to the ultimate resolution of each claim.

    The Owner may contact other previous owners to validate the information provided by the Bidder. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

h. Within five (5) years prior to the bid submittal date the Bidder must have completed a minimum of at least three (3) other projects for a Federal, State, or local governmental agency. The Bidder shall provide the following information pertaining to these three (3) projects:

    i. The contact information for the Federal, State, or local contracting agency for whom the project was completed;

ii. Description of the project;

iii. Start and completion dates for the project;

iv. Awarded contract amount;

v. Final contract amount;

vi. Other additional information or documentation pertaining to the projects as may be requested by the Owner.

The Owner may contact other previous owners to validate the information provided by the Bidder. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

i. **The Bidder shall have been duly incorporated and actively doing business in the State of Washington for a minimum of at least five (5) years prior to the bid submittal date. The Bidder shall provide the Owner with a adequate documentation confirming that the Bidder has been duly incorporated and actively doing business in the State of Washington for a minimum of at least five (5) years prior to the bid submittal date, including, but not necessarily limited to, documentation from the Washington State Secretary of State's Office.** Such documentation shall include, but is not necessarily limited to, a copy of the Bidder's Certificate of Existence / Authorization, a copy of the Bidder's Certificate of Incorporation / Formation / Authority, a certified copy of the Bidder's Original Registration Document (i.e., Articles of Incorporation, Certificate of Authority, Certificate of Formation, or Foreign Limited Liability Registration), and any other supporting information or documentation as may otherwise be requested by the Owner (including, but not necessarily limited to, copies of the Bidder's business licenses and contractor's licenses for the previous five [5] years prior to the bid submittal date). The Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

j. Within two (2) years prior to the bid submittal date the Bidder shall not have received any willful safety violations, and the Bidder shall not have received more than two (2) serious safety violations (i.e., WISHA / OSHA written citations) from the Washington State Department Labor & Industries or analogous agency with jurisdiction in the location the work was performed, regardless of whether such willful and/or serious safety violations have been abated or not. The Bidder shall provide Owner with a list of any and all willful and/or serious safety violations (i.e., WISHA / OSHA written citations) from the Washington State Department Labor & Industries (or analogous agency with jurisdiction in the location the work was performed), regardless of whether such willful and/or serious safety violations have been abated or not. The Owner may verify such information provided with the Washington State Department

Labor & Industries or analogous agency with jurisdiction in the location the work was performed. The Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is in compliance with this supplemental criteria.

k. Within five (5) years prior to the bid submittal date the Bidder shall have successfully completed at least one (1) other project of a similar size and scope as required by the contract documents for this project. The project must have had a total construction cost of at least $1,000,000. In evaluating whether the other project(s) was/were "successfully completed," the Owner may verify previous owner references for the previous project(s), and may evaluate the previous owner's assessment of the Bidder performance, including but not limited to the following areas:

    i. Quality control;

    ii. Safety record;

    iii. Timeliness of performance;

    iv. Use of skilled personnel;

    v. Management of subcontractors;

    vi. Availability of and use of appropriate equipment;

    vii. Compliance with contract documents;

    viii. Management of submittals process, change orders, and close-out.

    ix. Construction within occupied area.

    For the purposes of meeting this criterion, the Owner has determined that "similar size and scope" to this project means project(s) that have the following characteristics: (i) The awarded project(s) contract amount must have been of not less than $1,000,000; (ii) The project(s) must have included the renovation in excess of 3,000 square feet; and (iii) The project(s) must have included construction of within the occupied business spaces. The Bidder shall submit a list of other project(s) of similar size and scope to this project or larger, including information on a minimum of at least one (1) project of similar size and scope to this project or larger completed within five (5) years prior to the bid submittal date. The information about each project shall include the following:

        1. Owner's name and contact information for the owner's representative;

        2. Awarded contract amount;

3. Final contract amount;

4. A description of the scope of the project and how the project is similar to this project;

5. The Bidder's assessment of its performance of each project, including but not limited to the following:

    a. Quality control;

    b. Safety record;

    c. Timeliness of performance;

    d. Use of skilled personnel;

    e. Management of subcontractors;

    f. Availability of and use of appropriate equipment;

    g. Compliance with contract documents;

    h. Management of submittals process and change orders.

    i. Construction within occupied areas.

C. All Bidders must supply and provide the forgoing described bidder responsibility information, documentation, and materials to the satisfaction of the Owner. If a Bidder fails to supply the required bidder responsibility documentation, information, or materials, then Bidder may be determined by the Owner to be non-responsive, and the bid may be rejected on this basis. If the Owner determines the bidder does not meet the bidder responsibility criteria above and is therefore not a responsible bidder, the Owner shall notify the bidder in writing with the reasons for its determination. If the bidder disagrees with this determination, it may appeal the determination within twenty four (24) hours of receipt of the Owner's determination by presenting additional written information to the Owner. The Owner will consider the additional information before issuing its final determination. If the Owner's final determination affirms that the bidder is not responsible, the Owner will not execute a contract with any other bidder until two (2) business days after the bidder determined to be not responsible has received the final determination. Please note that the above-described information, materials, and documentation requested by the Owner for purposes of determining Bidder responsibility is not necessarily exclusive, and the Owner expressly reserves the right to request additional information, materials, and documentation as may be determined to be necessary or desirable by the Owner in order to evaluate and determine Bidder's compliance with the above-described bidder responsibility criteria. At all times, the Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is in compliance with the forgoing bidder responsibility criteria.

D. Certification Regarding Debarment Suspension or Ineligibility:

The Contractor certifies by signing this Agreement that Contractor is not presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participating in this contract by any federal department or agency. Further, Contractor agrees not to enter into any arrangements or contracts related to this contract with any party that is on the "General Service Administration List of Parties Excluded from Federal Procurement or Non-procurement Programs" at http://epls.arnet.gov/.

CONTRACTOR:

_____

Authorizing Signature

_____

Date

Federal Tax ID#:_____

Contractor Lic.#:_____

This form is to be submitted by the bidder with his bid.

SUPPLEMENTAL BIDDER RESPONSIBILITY - DECLARATION OF BIDDER

In accordance with the Contract Provisions and Plans the Bidder must provide the following sworn statement relevant to the supplemental bidder responsibility applicable to the project.

Name of Bidder: _____

Address: _____

Telephone No.: _____

E-Mail: _____

I, _____, the undersigned declarant, as the duly authorized representative on behalf of _____ (herein the "Bidder") hereby make this declaration on the basis of facts within the scope of my firsthand knowledge and authority to which I am competent to testify:

1. I hereby certify, swear, and affirm under penalty of perjury, that the Bidder has not been convicted of a crime involving bidding on a public works contract within the five (5) year period immediately preceding the bid submittal deadline for the project; and

2. I hereby certify, swear and affirm under penalty of perjury, that as of the date of this declaration (below), that the Bidder has hereby made a proper determination of bidder responsibility for all subcontractors for the project in accordance with the terms of RCW 39.06, RCW 39.04.350, and in accordance with the terms of the Bidder's written procedure for validating the responsibility of all subcontractors for the project with which the Bidder contracts; and

3. I hereby certify, swear and affirm under penalty of perjury, that the Bidder, has not had any public works contract terminated for cause by any State, Federal, or local government agency during the five (5) year period immediately preceding the bid submittal deadline for the project.

<u>This form is to be submitted by the bidder with his bid.</u>

Signed under penalty of perjury under the laws of the State of Washington this _____ day of _____, 2023, at _____, Washington.

Name of Bidder: _____

By: _____

Print Name: _____

Title: _____

STATE OF WASHINGTON

ss.

COUNTY OF _____

I certify that I know or have satisfactory evidence that _____ is the person who appeared before me, and said person acknowledged that he/she signed this instrument, on oath stated that he/she was duly authorized execute the instrument and acknowledged it as the _____ of _____, to be the free and voluntary act of such party for the uses and purposes herein mentioned.

DATED this _____ day of _____, 2023.

(SEAL)

_____
Notary Public
print name: _____
Residing at _____
My commission expires _____

END OF SECTION

This form is to be submitted by the bidder with his bid.

Summary of Required Submittals with Bid

1-02.1, B., d.

…..”The Bidder shall **submit a copy of its standard subcontract form for review by the Owner, a written description of the Bidder’s procedure for validating the responsibility of the subcontractors with which the Bidder contracts**, and a duly executed sworn statement (on the included form, or in a form otherwise determined to be acceptable by the Owner) that the Bidder has properly made a determination of responsibility for all subcontractors for the project….”

The information above is to be submitted by the bidder with his bid.

1-02.1, B., e.

“…..The Bidder shall submit a list of prevailing wage complaints filed against it within five (5) years of the bid submittal date along with a written explanation of each complaint, and how it was resolved….”

The information above is to be submitted by the bidder with his bid if applicable. If no complaints have been filed against the bidder, so state on paper, reference this section and submit with bid.

1-02.1, B., g.

“…..The Bidder shall submit a list of all public works projects that the Bidder has completed within the previous three (3) years prior to the bid submittal date, and include for each project the following information:

i. The owner for each public works project, and contact information for each owner.

ii. A list of claims filed against the retainage and/or payment bond(s) for each of the public works project.

iii. A written explanation of the circumstances surrounding each claim against the retainage and/or payment bond(s), and an explanation as to the ultimate resolution of each claim…”

The information above is to be submitted by the bidder with his bid.

1-02.1, B., h.

“….Within five (5) years prior to the bid submittal date the Bidder must have completed a minimum of at least three (3) other projects for a Federal, State, or local governmental agency. The Bidder shall provide the following information pertaining to these three (3) projects:

iv. The contact information for the Federal, State, or local contracting

agency for whom the project was completed;
v. Description of the project;
vi. Start and completion dates for the project;
vii. Awarded contract amount;
viii. Final contract amount;
ix. Other additional information or documentation pertaining to the projects as may be requested by the Owner…."

The information above is to be submitted by the bidder with his bid.

1-02.1, B., i.

"…..The Bidder shall provide the Owner with adequate documentation confirming that the Bidder has been duly incorporated and actively doing business in the State of Washington for a minimum of at least five (5) years prior to the bid submittal date, including, but not necessarily limited to, documentation from the Washington State Secretary of State's Office. Such documentation shall include, but is not necessarily limited to, a copy of the Bidder's Certificate of Existence / Authorization, a copy of the Bidder's Certificate of Incorporation / Formation / Authority, a certified copy of the Bidder's Original Registration Document (i.e., Articles of Incorporation, Certificate of Authority, Certificate of Formation, or Foreign Limited Liability Registration), and any other supporting information or documentation as may otherwise be requested by the Owner (including, but not necessarily limited to, copies of the Bidder's business licenses and contractor's licenses for the previous five [5] years prior to the bid submittal date)…"

The information above is to be submitted after the bid opening by the (2) two low bidders within 10 days of the bid opening.

1-02.1, B., j.

"…..The Bidder shall provide Owner with a list of any and all willful and/or serious safety violations (i.e., WISHA / OSHA written citations) from the Washington State Department Labor & Industries (or analogous agency with jurisdiction in the location the work was performed), regardless of whether such willful and/or serious safety violations have been abated or not…"

The information above is to be submitted by the bidder with his bid if applicable. If no safety violations have been filed against the bidder, so state on paper, reference this section and submit with bid.

1-02.1, B., k.

"….The Bidder shall submit a list of other project(s) of similar size and scope to this project, including information on a minimum of at least one (1) project of similar size and scope to this project completed within five (5) years prior to the bid submittal date. The information about each project shall include the following:

1. Owner's name and contact information for the owner's representative;

2. Awarded contract amount;
3. Final contract amount;
4. A description of the scope of the project and how the project is similar to this project;
5. The Bidder's assessment of its performance of each project, including but not limited to the following:
    a. Quality control;
    b. Safety record;
    c. Timeliness of performance;
    d. Use of skilled personnel;
    e. Management of subcontractors;
    f. Availability of and use of appropriate equipment;
    g. Compliance with contract documents; Management of submittals process and change orders…."

1-02.1, D.

A. Certification Regarding Debarment Suspension or Ineligibility:

The information above is to be submitted by the bidder with his bid.

SECTION 00 52 00
AGREEMENT FORM

PART 1 - GENERAL

A. The "Standard Form of Agreement Between Owner and Contractor", AIA Document A101, 2017 Edition, is a part of these Contract Documents and is incorporated as fully as if bound herein.

B. The Agreement Form may be obtained from the Architect's office, or from the American Institute of Architects, 1735 New York Avenue NW, Washington D.C. 20006; Seattle Chapter, American Institute of Architects, 1911 First Avenue, Seattle, WA 98101; and Northwest Washington Chapter, American Institute of Architects as follows:

1. https://aiacontracts.org

C. Modifications to AIA Document A101, 2017 edition are attached in Exhibit F.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 00 61 00
BONDS AND CERTIFICATES

The bond and insurance requirements set forth on the following pages are required of the successful bidder.

1.01 **GENERAL:** In addition to the Bid Guarantee required in the advertisement, Skagit County requires the Contractor to furnish the following bonds and insurance. The inception date of the insurance coverage shall be the date the Contractor is ordered by Skagit County to proceed with the work and shall be maintained during the life of the Contract and for not less than one year thereafter.

1.02 **EVIDENCE OF COMPLIANCE:**

A. Performance, Labor and material Payment Bonds: Submitted at time of execution of the Contract and attached thereto.

B. Insurance: A Certificate of Insurance shall be filed with "Skagit County." This Certificate shall be reflective of all Insurance Coverage required by the County's contract documents. Any Certificate filed with the County found to be incomplete or not according to Form, will be returned as not satisfactory. Rejected Certificates shall be corrected as necessary and resubmitted to the county for approval. Certificates of Insurance shall indicate the following to be Additional Named Insureds:

In addition to the foregoing, the Certificate of Insurance must include a Cancellation Notification of not less than thirty (30) days. The Certificate should also contain the Contract Number and a "concise verbal definition" of the Contract to which the Certificate applies.

1.03 **INSURANCE GENERALLY:** The Contractor shall not commence work under this contract until he has obtained the insurance required hereunder and such insurance has been approved by the County. In like manner, the General Contractor shall not allow any subcontractor to commence work on any subcontract until the subcontractor has submitted to the General Contractor a Certificate of Insurance reflective of the coverage required by Skagit County. Skagit County's approval of insurance shall not relieve or decrease the Contractor's liability hereunder. Each policy shall contain an endorsement stating that the insurance company will not, prior to the completion of the Work or any expiration date shown on the policy and certificate, whichever occurs first, terminate the policy or change any coverage therein without first mailing, by registered mail, written notice of such action at least 30 days prior to the termination or change, to Skagit County.

1.04 **CONTRACTOR'S LIABILITY INSURANCE**: The insurance required, by Skagit County, is as specified below and in the amounts indicated:

A. Worker's Compensation and Employer's Liability Insurance: All employees of the Contractor and subcontractors shall be insured under Washington State Industrial Insurance. Employees not subject to the State Act shall be insured under Employer's Liability with a $1,000,000.00 limit of liability. A separate Certificate of Insurance shall

be furnished to Skagit County of any of the Contractor's payroll is not reported to the Washington State Industrial Insurance. The contractor shall be responsible for confirming compliance of all subcontractors with the above requirements.

B. Comprehensive General Liability and Comprehensive Automobile Liability Insurance: The Contractor shall obtain and retain Bodily Injury and Property Damage Liability Insurance providing the following:

1. Additional Insured: Skagit County, its employees, and Alana, Buick & Bers shall be named as additional insured for liability arising out of the work of this Contract as a result of the negligence, real or alleged, on the part of the contractor and his subcontractors.

2. Limits of Liability: Limits shall equal or exceed the combination or primary and excess limits for bodily injury and property damage liability of $2,000,000.00 annual aggregate.

3. Coverage: Coverage shall be as is usual to the practice of the Insurance Industry; included but not limited to the following coverages:

   a. Premises and Operations including Explosion, Collapse and Underground Liability;

   b. Products and completed Operations;

   c. Owners and Contractors Protective Liability;

   d. Broad form Property Damage Liability;

   e. Blanket Contractual Liability;

   f. Personal Injury Liability, including coverage's A, B, and C;

   g. Employers "Stop-Gap" Liability;

   h. Automobile Liability for All Owned, Non-Owned, Hired Leased or Borrowed Vehicles:

   i. Un-insured and Under-insured Motorist Coverage should also be in effect.

4. Products and Completed Operations Insurance: This coverage must be maintained for a period of not less than two years after the final acceptance of the work performed.

5. An Umbrella and Excess Liability coverage in limits not less than $9,000,000 per project per occurrence is required.

1.05 PROPERTY INSURANCE: Unless otherwise provided, the Contractor shall purchase and maintain property insurance upon the entire Work at the site to 115 percent of the

full value thereof. This insurance shall include the interests of Skagit County, the Contractor and all subcontractors in the Work being performed. The coverage should be written on a "Builder's Risk" basis. All materials which are to be made part of the construction project are to be so insured while being stored at or off the job site(s) and / or while being transported to and from the job site(s). Insurance against loss of tools, equipment, construction, or otherwise not to be incorporated into the Work is the responsibility of the Contractor and the cost of such insurance shall not be included in the cost of insurance required herein before.

A. Endorsements: The policy shall be specifically endorsed as follows:

1. Payments: It is agreed that loss payments under the policy shall be made payable to Skagit County as trustee for each of the interests named in the policy.

B. Waiver: Skagit County and the contractor waive all rights against (1) each other and the subcontractors, sub-subcontractors, agents and employees each of the other, and (2) the Owner for damages caused by fire or other perils to the extent covered by insurance obtained pursuant to this Article or any other property insurance applicable to the Work, except such rights as they may have to the proceeds of such insurance held by Skagit County, as trustee.

1.06 PROFESSIONAL LIABILITY

A. Contractor shall be required to maintain Professional Liability insurance in the amount of $5,000,000, or limits carried, whichever is greater and continuing in force by renewal or by an extended reporting provision for not less than six (6) years after completion of the Project or the statute of repose, whichever is greater. This coverage form shall be "claims made" form. The policy shall not contain any exclusions or restrictions for residential development or any exclusion or limitation applicable to work or operations of the type contemplated by this Agreement.

1.07 POLUTION LIABILITY

A. Contractors Pollution Legal Liability coverage for bodily, property damage and environmental damage and claims expenses arising at or emanating from the Project arising from all contracted operations performed on behalf of the Owner. Coverage shall include sudden and completed operations coverage for a period of six years after Substantial Completion. The minimum limits required are $5,000,000 each occurrence and $5,000,000 Aggregate.

1.08 BONDS

A. Performance and Payment Bonds: Furnish surety bond in the form of AIA Document A312 in an amount equal to 100 percent of the Contract Sum covering faithful performance of the work and payment of labor and materials. Furnish bonds issued by a bonding company licensed to transact business in the locality of the Work and approved by the Owner.

END OF SECTION

SECTION 00 61 13
PERFORMANCE BOND AND PAYMENT BOND

PART 1 - GENERAL

A. The "Performance Bond and Payment Bond", AIA Document A312, 2010 Edition, is a part of these Contract Documents and is incorporated as fully as if bound herein.

B. The Performance Bond and Payment Bond Form may be obtained from the Architect's office, or from the American Institute of Architects, 1735 New York Avenue NW, Washington D.C. 20006; Seattle Chapter, American Institute of Architects, 1911 First Avenue, Seattle, WA 98101; and Northwest Washington Chapter, American Institute of Architects as follows:

1. https://aiacontracts.org

C. Contractor may use their standard bid security form as acceptable substitution.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 00 62 16
CERTIFICATES OF INSURANCE

Certificates of Insurance Requirements:

1. Certificate shall be issued on an ACORD Form, or a form that meets with Skagit County's approval.

2. The Insuring Company shall have a Best Rating of A+ or meet with Skagit County's approval.

3. The minimum acceptable General Liability Limit shall be $2,000,000 Aggregate / $1,000,000 Occurrence. Coverage shall include owners & Contractors Protective Liability and Employers Liability (Stop-Gap) Coverage.

   Coverage shall be written on an "Occurrence" Basis or meet with Skagit County's approval.

4. Automobile Coverage shall include "Any Auto" or "Scheduled Autos" and shall include Hired and Non-Owned Auto Liability.

   The minimum acceptable Automobile Liability Limit shall be $1,000,000.

5. Umbrella and Excess Liability coverage shall be not less than $9,000,000 per project per occurrence, excess of all primary coverage on Commercial General and Auto Liability.

6. Skagit County, it's Commissioners and Employees, and Alana, Buick &., shall be added as Additional Insureds on the Certificate, and a separate endorsement shall be issued by the Company adding Skagit County, it's Commissioners and Employees, and Interface Engineering as Additional Insured to the General Liability and Automobile Policy and the Umbrellas Excess Policy, where required to meet minimum limits outlined in #3 and #4 above.

7. The "Cancellation" Block shall be altered to include the wording "Should any of the above-described policies be canceled or materially reduced before expiration date thereof, the issuing company will mail 30 days written notice to the certificate holder named to the left."

If there are any questions regarding these requirements please contact Skagit County's Risk Manager, Mary Houben, 360-416-1384.

END OF SECTION

SECTION 00 62 91
RETAINAGE INVESTMENT OPTION

Contractor: _____ Project Name: _____

Date: _____ Project Number: _____

Pursuant to RCW 60.28.010, as amended, you may exercise an option as to how retainage under this contract will be invested. Please complete and sign this form indicating your preference; if you fail to do so, the Owner will deposit funds in a Guarantee Deposit account, and you will miss the benefit of any interest earned. Select one of the following options:

[ ] 1. Savings Account: Money will be placed in an interest bearing account. The interest will be paid to you directly, rather than kept on deposit. If you prefer a particular bank, state its name:

[ ] 2. Escrow / Investments: The Owner will deliver retainage checks to a selected bank, pursuant to an escrow agreement. The bank will then invest the funds in securities or bonds selected by you, and interest will be paid to you as it accrues.

Preferred Bank: _____

Securities / Bonds: _____

[ ] 3. Guarantee Deposit: Retainage will be deposited in a manner selected by the Owner. No interest is payable to the Contractor.

Retainage is normally released 30 days after final acceptance of the work, or following receipt of Labor and Industries/Department of Revenue clearance, whichever date is the later. Retainage on landscaping work may be retained longer, due to its seasonal nature. State law allows for limited early release in certain circumstances.

_____
(Contractor's Signature)

_____
Title

END OF SECTION

SECTION 00 72 00
GENERAL CONDITIONS

PART 1 - GENERAL

A. The "General Conditions of the Contract for Construction", AIA Document A201, 2017 Edition, is a part of these Contract Documents and is incorporated as fully as if bound herein.

B. The General Conditions of the Contract for Construction document may be obtained from the Architect's office, or from the American Institute of Architects, 1735 New York Avenue NW, Washington D.C. 20006; Seattle Chapter, American Institute of Architects, 1911 First Avenue, Seattle, WA 98101; and Northwest Washington Chapter, American Institute of Architects as follows:

1. https://aiacontracts.org

C. Modifications to AIA Document A201, 2017 edition are attached in Exhibit F.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 00 73 43
WAGE RATE REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This schedule of prevailing wage rates for the locality or localities of the Work, as described by the Industrial Statistician of the Department of Labor and Industries, is included for ease of reference. Contractor remains solely responsible for verifying that the rates shown within this Section are accurate, current, and inclusive for all parts of this Work. Contractor is responsible for notifying the Architect, in writing, of any problems, errors, or discrepancies in this Section no later than 7 working days prior to Bid opening. Any off-site prefabrication may also require prevailing wages and the Contractor should contact the Department of Labor and Industries to ascertain those rates.

B. Contractor to provide the "Notice of Intent to Pay Prevailing Wage Rates", as required by RCW 39.04, 39.12, 43.19, and 49.28 as amended. All paperwork regarding "Notice of Intent to Pay Prevailing Wage Rates" shall be sent directly to the owner. The rules and regulations of the Department of Labor and Industries and the schedule of prevailing wage rates for the locality or localities where this Contract will be performed as determined by the Industrial Statistician of the Department of Labor and Industries, are by reference made a part of this Contract as though fully set forth herein.

Current prevailing wage data are available online or at the following:

ADDRESS: Department of Labor and Industries
Prevailing Wage Section
P.O. Box 44540
Olympia, Washington 98504-4540

https:// lni.wa.gov/licensing-permits/public-works-projects/prevailing-wage-rates/

The General Contractor and his sub-contractors are to pay for all filing fees for Statements of Intent to Pay Prevailing Wages and Affidavits at $40.00 each document submitted. Pay for any change in rate during the course of construction.

Submit forms to: Department of Labor and Industries
Prevailing Wage Section
P.O. Box 44540
Olympia, Washington 98504-4540

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 00 82 50
SPECIAL CONDITIONS

The project is to remove unused portions of the 4th floor reinforced concrete jail facility located on the roof of the 1924 Skagit County Courthouse. The Project consists of furnishing all labor, materials, and other incidentals to remove major portions of this rooftop jail structure as per the Special Provisions, the Standard Specifications including the amendments thereto, and Contract Documents hereunder. The Architect's estimate is $2,400,000 for the project located at 205 W Kincaid St, Mount Vernon, WA 98273.

1. A pre-bid conference for prospective bidders will be held at the Courthouse, 205 W Kincaid St, Mount Vernon, WA 98273 at 9:00 AM on October 18, 2023. Group will meet by north entry (parking lot side) of the Courthouse.

2. The Owner / Architect will make application for the building permits. The Owner shall pickup and pay for the building permit. Contractor shall be responsible to pay for and procure separate electrical permit.

A. ACCESS TO WORK

The Owner's designated project Coordinator shall have full access to the site after normal working hours. Access during normal working hours to courtrooms, judges' chambers, private offices, and occupied cubicle spaces may be requested ahead of time by the Contractor, although there is no guaranteed access due to staff and court obligations.

B. PREVAILING WAGES

Contractor and subcontractors shall submit a "Statement of Intent to Pay Prevailing Wages" prior to submitting first application for payment. Each statement of intent to pay prevailing wages must be approved by the Industrial Statistician of the Department of Labor and Industries before it is submitted to the County. Unless otherwise authorized by the Department of labor and Industries, each voucher claim submitted by a Contractor for payment on a project estimate shall state that the prevailing wages have been paid in accordance with the pre-filed statement or statements of Intent to Pay prevailing Wages on file with the public agency.

C. AFFIDAVIT OF WAGES PAID

Following the final acceptance of a Public Works project, the Contractor and each and every subcontractor shall submit "Affidavit of Wages Paid" before the funds retained according to the provisions of RCW 60.28.010 are released to the Contractor. Each Affidavit of Wages Paid must be certified by the Industrial Statistician of the Department of Labor and Industries before it is submitted.

D. SUBMITTAL FEES

"Intent to Pay Prevailing Wages" and "Affidavit of Wages Paid" must be submitted to the Industrial Statistician of the Washington State Department of Labor and Industries accompanied by current rate for each individual form. This fee is to be paid by the

Contractor. All bidders are advised to consider these charges when tabulating their bids.

E. RETAINED PERCENTAGE

The Contractor shall comply with Title 39 RCW and Ch. 60.28 RCW.

F. SPECIAL REPORTS

General: Submit special reports directly to the Owner within one day of an occurrence. Submit a copy of the report to the Architect and other entities that are affected by the occurrence.

Reporting Unusual Events: When an event of an unusual and significant nature occurs at the site, prepare and submit a special report. List chain of events, persons participating, response by the Contractor's personnel, and evaluation of the results or effects and similar pertinent information.

Reporting Accidents: Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

G. PAYMENT REQUESTS

Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issues by the Architect, the Owner shall make progress payments on account of the Contract Sums to the Contractor as provided in the Contract Documents for the period ending the twenty-fifth (25) day of the month as follows:

1. The Contractor shall submit Applications for Payment for the preceding month by the first day of each month. The Owner shall make progress payments to the Contractor not later than thirty (30) days following the Architect's receipt of the Application for Payment from the Contractor.

2. The Owner shall pay to the Contractor, on each application for Payment, materials, equipment incorporated in the Work and to materials and equipment suitably stored at the site or at some other location agreed upon in writing, for the period covered by the application for Payment, less the aggregate of previous payments made by the Owners.

The Owner will not be liable for interest or penalties charged by the Contractor on any Payments delayed due to Contractor's failure to inform himself of the Owner's normal procedures or to submit payment requests timely.

The Contract Sum and any agreed variations thereof, shall include all Federal, State and Local taxes imposed by laws, and properly chargeable to the project except the State of Washington Sales Tax. Washington State and Local Sales Taxes as applied to the materials and labor or equipment which becomes part of the Work will be paid by the Owner; a proportionate amount of the tax will be added to each payment voucher issued to the

Contractor. The Contractor shall pay all other sales, consumer, use and similar taxes properly levied by Washington State and Local Agencies for the Work or portions thereof provided by the Contractor which are legally enacted at the time bids are received, whether or not yet effective. For payment requests, use AIA Form G702, fully completed, executed and notarized. Submit the forms in triplicate, including attachment of waivers and similar documentation with one copy. Prior to the initial payment request, submit:

1. List of principal subcontractors and suppliers, including contact persons and their addresses and telephone numbers.

2. List of principal staff assignments with addresses and telephone numbers.

3. Schedule of Values.

4. Construction Schedule.

Following issuance by Architect of Certificate of Substantial completion, Contractor may submit special payment request, provided the following have been completed:

1. Obtain permits, certificates of inspection and other approval and releases by governing authorities, required for Owner's operational / maintenance personnel.

2. Complete final cleaning of work.

3. Submit as-built documents.

4. Submit listing of work to be completed before final acceptance.

Following completion of the following requirements, final payment request may be submitted:

1. Complete work listed as incomplete at time of substantial completion, or otherwise assure Owner of subsequent completion of individual incomplete items.

2. Settle liens and other claims or assure Owner of subsequent settlement.

3. Submit proof of payment on fees, taxes and similar obligations.

4. Transfer operational, access, security and similar provisions to Owner; and remove temporary facilities, tools and similar items.

5. Affidavits of Wages Paid from all entities who worked at the site.

6. Completion of requirements specified in "Contract Closeout" section.

7. Obtain consent of surety for final payment.

8. Provide evidence of full payment of all industrial insurance premiums as required by RCW 51.12.050 and / or RCW 51.12.070.

Payments will be mailed to Contractor's place of business. Payments cannot be picked up personally.

END OF SECTION

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 INTRODUCTION

The primary objective of this project is to remove unused portions of the 4th floor reinforced concrete jail facility located on the roof of the 1924 Skagit County Superior Courthouse. The Project consist of furnishing all labor, materials, and other incidentals to remove major portions of this rooftop jail structure. The primary objective of this Project is to reduce the seismic demands on the three floors of the working Superior Courthouse below. The Project includes retention of the existing stair, elevator, and mechanical room equipment servicing the floors below. All existing roof assemblies and a Cooling Tower will be removed and replaced as part of the Work. As the Courthouse will be in use during the construction period, the existing cooling tower and select plumbing equipment in mechanical room shall remain operable during working hours of the Courthouse. Additionally, all work on project causing noise, odors or air-borne debris shall be performed only when the Courthouse is not in use.

1.2 EXISTING CONSTRUCTION

The Courthouse structural elements, from 1924, include multi-wythe brick exterior walls with reinforced concrete interior walls, columns, floor, and roof assemblies. Nonstructural elements of the Courthouse include exterior terra cotta decorative features, 4" clay tile walls, lathe and plaster wall and ceiling assemblies.

The Jail structure on the 4th floor is set back from the building parapets. The jail is a reinforced concrete structure with interior clay tile walls, jail cells with steel bars, lathe and plaster wall and ceiling assemblies.

In 1992, the parapet of the Courthouse was rebuilt with reinforced CMU wall behind the brick and terracotta façade. Steel braces were attached from the parapet to the roof of 3rd floor and to the Jail exterior walls.

In 2007, a new PVC single ply roof assembly was applied over existing roof. As this roof is at the end of its warranty, the entire existing roof assembly will be removed down to the existing concrete 3rd floor roof.

1.3 AVAILABLE DOCUMENTS

Appendix A: 1924 Partial Structural and Architectural Drawings
- **A1** -Jail Roof (1988 sketch) and 4th Floor Partial Framing Plans (1924)
- **A2** -1924 Original Architectural Plans

Appendix B: 1992 Courthouse Parapet Remodel (Structural)
Appendix C: 2007 Roof Drawings
Appendix D: 2019 Seismic Report
Appendix E: Asbestos Lead Testing Reports
- **E1:** 2003-11-24 Roof Asbestos Survey
- **E2:** 2009-03-13 Phillips Lead Asbestos brick-parapets
- **E3:** 2018-06-08 PBS Asbestos Lead Windows Doors Stair Handrails
- **E4:** 2020-03-23_Lead Asbestos Testing Jail-Interior
- **E5:** 2023-02-24 Whatcom Env & LVV, Lead Asbestos - paint, caulk, plaster

Appendix F: AIA Contract templates

1.4 REMEDIATION CONTRACT DOCUMENTS GENERAL NOTES

These contract documents do not contain an "as built record", nor do they provide extensive detailing of the existing conditions. These documents provide anticipated structural, mechanical, electrical, plumbing and weatherization details and processes one could infer from visual observations of existing conditions. During demolition and construction, Contractor shall provide Requests for Information (RFI's) where additional details are needed to facilitate appropriate repairs of conditions not described herein.

Remediation projects of this nature require a collaborative team approach to be successful. Weekly project meetings, periodic Field Reviews, mock-ups of assemblies, product manufacturer representation for warranty reviews, procedures and clear communication between the Contractor, Architect, Engineer, and Owner are critical to resolving decisions needed during the construction process.

1.5 SUMMARY OF WORK

The following generally describes the Summary of Work for the project. These descriptions shall be used in combination with the Drawings and related Specifications to perform the Work.

1) All work on project causing noise or air-borne debris shall be performed only when courthouse is not in operation. Hours of allowable work during these impactful periods is anticipated to include following:
    a) Monday to Friday (except legal holidays): 5:00 PM to 7:00 AM
    b) Saturday and Sunday
    c) Legal Holidays
    d) Other days, only with permission of Superior Court
2) Contractor shall assume all work on project causing noise or airborne debris shall be performed only when the Courthouse is not in operation.
    a) **DEDUCTIVE BID ALTERNATE**: Contractor has the option to provide a Deductive Bid Alternate for a 2-week period during which time the County will vacate the premises and allow longer construction working hours. If allowing two weeks of unrestricted working hours would provide a significant benefit to the County and completion of this project, the County will consider this option prior to contract.
3) Contractor shall be allowed access to work at north entry (ADA ramp). This entry provides access to the elevator and stairs to the roof. Elevator will be key access to 4th floor area of Work. Contractor access to other floors requires permission from Owner.
4) GC shall provide a written demolition and construction plan indicating following:
    a) Security and Safety plan during course of work.
    b) Method of removal (Cranes, Lifts or other systems used to perform the Work).
    c) Location of debris stockpiling
    d) Provide types and weights of equipment used for demolition work. To avoid overloading the existing 3rd floor ceiling during construction, the structural engineer has provided an allowable load map to provide an allowance for stockpiling debris and what weight of equipment will be allowed on the roof top. Bidder shall comply with the Structural engineer's allowable load limits of the 3rd floor roof.
5) Contractor shall provide a detailed photo record of the existing condition of ceilings, walls, and floors at 3rd floor prior to construction start. Contractor shall at the end of each work shift inspect condition of ceiling and walls below. If any damage is found, Contractor shall report this to the team and provide a repair timeline. Any damage caused by GC shall be responsibility of GC to repair in a timely manner.
6) Provide weather protection of entire roof area during critical phases of construction, including but not limited to: Demolition, Framing, Cladding, Roofing, Mechanical, Electrical, Plumbing phases. Any damage caused by GC shall be responsibility of GC to repair in a timely manner.

7) All roof top mechanical HVAC supply and return ducts must be encapsulated during construction processes producing odor or dust content. Coverings shall be removed after completion of construction and prior to opening of Courthouse workday.

8) The existing Cooling Tower and select plumbing equipment, such as water heaters, in the mechanical room shall remain operable during working hours of the Courthouse. Replacement of cooling tower must be performed when courthouse is closed and must be operational when Courthouse is open and air conditioning interior. GC is responsible for verifying equipment serving Courthouse are in operating condition before leaving the site. GC must assign a person an employee to be on call to coordinate any equipment required to be in use by Courthouse during open hours.

9) Provide temporary heating during installation of assemblies requiring specific minimum temperatures.

10) Provide testing for Lead and Asbestos content where required by law. Owner has provided test reports in Appendix A. If additional testing is required, Contractor shall make requests in writing per Contractual Agreement.

11) Use of adjacent parking spaces for field office, storage area, Sani-Cans, parking, and other construction facilities are available, pending approval by Owner.

12) Provide scaffolding and/or lifts to perform work. Ensure access to exits and Fire Department doors are not blocked.

13) Obtain necessary street use permit, when needed, to perform work.

14) Contractor to provide temporary barricades or other means of protection to always maintain a safe work site.

15) Contractor shall protect materials and surfaces not impacted by the construction.

16) Contractor shall always maintain a clean work site. It will be expected that the site will be left in a broom clean state at the end of each workday.

17) Contractor is responsible for properly labeling and storing materials removed from the buildings that are intended to be reinstalled. Any damage to such items will be the sole responsibility of the Contractor.

18) Existing fire suppression systems include sprinklers at floors 1 to 3. At floor 4, Class 2 Standpipes are located to the south of the elevator and to the west of the Mechanical Room. These Class 2 Standpipes shall be relocated to the interior of heated spaces at the Hall and the Mechanical room. Routing could be accommodated under the new roof insulation, or as required by licensed fire suppression contractor. Contractor's price shall include all costs associated with relocation of these Class 2 standpipes.

19) A licensed electrical contractor shall be hired by the Contractor to perform any electrical work. Electrical permits shall be provided by Contractor.

20) A licensed plumbing contractor shall be hired by the Contractor to perform any plumbing work. Plumbing permits shall be provided by Contractor.

21) A licensed mechanical contractor shall be hired by the Contractor to perform any Mechanical/HVAC work. Mechanical permits shall be provided by Contractor.

22) Submittals: Contractor is responsible for submitting on all new materials, coatings, sealants and other elements used on this targeted repair project. Contractor shall submit on products used with a transmittal with relevant construction information.

23) Material installations shall be as per manufacturer's instructions and as indicated on Construction Documents. Any variations from these instructions shall be recorded by the RFI process.

24) Meetings: Contractor shall be available for consultant and Owner meetings for a period of 2 hours each

25) Remove all elements within area of demolition as described in Contract Documents.

26) Means and methods for removal shall be responsibility of Contractor.

27) Temporary support during course of work shall be responsibility of Contractor.

28) Refer to Structural drawings and specifications for extent of structural work required. Work shall include replacement of braces supporting courthouse parapets and new steel framing to replace walls and roof structural elements at the Elevator/Stair Tower and Mechanical Room.

29) Refer to Mechanical, Electrical and Plumbing (MEP) drawings and specifications for extent MEP work required.

30) Replace existing Cooling Tower as per MEP, Architectural and Structural Documents. Existing Cooling Tower shall remain operational during air conditioning season until such time as new Cooling Tower can be placed in use. There shall be no down time of the Cooling equipment during open hours of the Courthouse.

31) Existing water heaters in Mechanical Room shall remain operational during open hours of the Courthouse.

32) Elevate roof top mechanical equipment as required to remove and allow for installation of new roofing assemblies. Replacement of cooling tower must be performed when courthouse is closed and must be operational when Courthouse is open.

33) Roofing assembly typical: Provide a 60-mil nominal (78 mil including fleece) PVC fully-adhered roof assembly per Drawings and Specifications. Manufacturer warranty shall be a 30-year NDL with a 5-year installer warranty (*07 54 19 PVC Roofing*)

34) Interior of perimeter parapet walls, existing concrete walls to remain and steel braces shall be coated with Silicone elastomeric per drawings and specifications (0*9 96 50).*

35) Replacement exterior walls and roofs shall be constructed per Structural and Architectural documents.

36) New hollow metal insulated doors shall be provided per architectural documents (08 11 13).

37) Existing windows at stair hall will be removed and replaced with exterior wall assembly and a new fixed storefront window at the stair enclosure.

38) Existing and new interior walls and ceilings in areas of work shall be primed and painted. No work will be done to existing floors, other than cleaning.

39) Final cleaning and close out of project (*01 78 00*).

1.6 CONTRACTOR RESPONSIBILITIES

A. Unless otherwise indicated, work and responsibilities include, but are not limited to the following:
   1. Employing specialists having experience in similar restoration projects and in sufficient numbers for supervision and coordination of construction activities, including those by subcontractors and suppliers, and as required to maintain the Construction Progress Schedule and complete the work by the dates indicated in the Construction Progress Schedule.

   2. Providing and paying for labor, materials, equipment, tools, machines, facilities, and services necessary for proper execution, supervision and completion of work.

3. Performing initial review and certification that submittals are complete and comply with requirements of the Contract Documents before submitting to Owner's Project Manager and A/E for review.

4. Paying required taxes.

5. Giving required notices to occupants of buildings, city officials and design team.

6. Using new materials, except as noted.

7. Maintaining required egress and other requirements in accordance with governing Codes and Ordinances throughout the work.

8. Obtaining and paying for Mechanical, Electrical, Plumbing and Fire Suppression permits, fees and notices. Note, Building Permit Fees will be paid by Owner.

1.7 MISCELLANEOUS EXPLANATIONS - INTENT

B. Intent of Drawings:
1. The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams. Drawings are in part diagrammatic and do not necessarily show complete details of construction, work or materials, performance or installation. They do not necessarily show how construction details, other items or work, fixtures, and equipment may affect any particular installation. Contractor shall ascertain and correlate the work to bring the parts together into a satisfactory and completed whole.

2. Drawings do not show exact characteristics of the Work, and indicate only such details as are necessary to show intent of the work. In order to illustrate the Work, the A/E may furnish additional Drawings, explanations and clarifications consistent with the original Drawings, purpose and intent of the Contract. Contractor shall conform Work to such Drawings and explanations. The furnishing of such additional Drawings, explanations or clarifications is for the convenience of the Contractor and shall not entitle the Contractor to an increase in the Contract time or Contract Sum.

3. Furnish and install work not covered under any heading, Section, branch, class or trade of the Project Manual, but shown on or reasonably inferable from the Drawings. This includes work necessary to produce the intended results.

4. Do not scale drawings. Dimensional accuracy is not guaranteed, and field verification of dimensions, locations, and levels to suit field conditions is required.

C. First Class Workmanship is expected.
1. Prior to installing an item or material, verify that receiving surfaces are plumb, level, true to line, and straight to the degree necessary to achieve tolerances specified or required. Perform without extra cost shimming, blocking, grinding, or patching required to make such surfaces plumb, level, true to line and straight.

2. Take care in attention to details and fitting at intersections and junctures of materials. Joints are to be tight, straight, even, and smooth.

D. Fastening and Connections: Furnish fastenings and connections necessary and adequate to assemble work whether indicated or not. Provide proper assemblage for intended performance of components and assemblies.

E. Presence of A/E or Owner: Do not construe presence of A/E or any of the Owner's representatives at the Project Site as assuring compliance with Contract Documents.

F. General Installation Provisions: Provide items, articles, materials, and operations listed, including labor, materials, equipment and incidentals required for their completion.
   1. Installer's Inspection of Conditions:
      a. Require the installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed.
      b. The installer shall report unsatisfactory conditions in writing to the Contractor.
      c. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Start of work constitutes acceptance of substrates.
   2. Inspection of Items to Be Installed:
      a. Inspect each item of material or equipment immediately prior to installation.
      b. Reject damaged and defective items.

   3. Attachment and Connection:
      a. Provide attachment and connection devices and methods for securing work. Secure work true to line and level, and within recognized industry tolerances. Allow for expansion and building movement.
      b. Provide uniform joint width in exposed work. Arrange joints in exposed work as drawn or to obtain the best visual effect. Refer questionable visual-effect choices to the A/E for final decision.

   4. Measurements: Check measurements and dimensions of the work, as an integral step of starting each installation.

   5. Dimensions and Measurements on Drawings:
      a. Dimensions govern.
      b. Do not scale.
      c. Check dimensions in the field and verify them with respect to adjacent or incorporated work.
      d. Information concerning existing conditions was considered suitable for preparation of the Drawings and is given for Contractor's convenience. A/E and Owner do not guarantee accuracy of such conditions.

   6. Weather Conditions:
      a. Install each unit of work during weather conditions and project status to ensure the best possible results in coordination with the entire work.
      b. Isolate each unit of finished work and protect as necessary to prevent deterioration.

   7. Inspection and Tests: Coordinate enclosure of the work with required inspections and tests, to minimize the necessity of uncovering work for that purpose.

1.8 CONTRACT

A. Contract: Construct work under a single, lump-sum fixed-price Contract. Reference General Conditions (Section 00 72 00)

1.9 OWNER'S REPRESENTATIVE

A. This Project is administered by Skagit County's Project Manager in Facilities Management.

1.10 SEQUENCE/PHASING

A. Use any sequence of operations compatible with monthly Progress Schedule, in accordance with Section 00 72 00, General Conditions – Stipulated Sum (Single-Prime Contract), and Section 01 32 00, Construction Schedule and Reports

B. These documents shall not be interpreted implicitly or explicitly as definition of procedure and sequence of operations.

1.11 CONTRACTOR'S USE OF PREMISES

A. Contractor shall have use of the premises for execution of the work during the Contract time. Schedule and coordinate work in areas indicated as "intermittent work areas" to minimize impacts to Owner use.

B. Construction Staging Area: Coordinate use of Project Site with the Owner prior to utilization of area and during the construction phases. Modify or change the staging and parking areas as required by the Progress Schedule described in and Section 01 32 00, Construction Schedule and Reports.
   1. Contractor is responsible for renting adjacent parking spaces as needed for construction facilities.
   2. Coordinate staging and parking areas with subcontractors and material suppliers.

C. Assume full responsibility for the protection and safekeeping of products and equipment under this Contract, stored on the Project Site.

D. At no cost to Owner, move any stored products under Contractor's control which interfere with operations of the Owner or other contractors.

E. Obtain and pay for the use of additional storage or work areas off Project Site as needed for operations.

F. Do not allow storage of flammable liquid or hazardous materials in any portion of the building including mechanical or electrical equipment rooms.

1.12 EXISTING UTILITIES

A. Utilities of record are shown on the Drawings or on record drawings available for review at the office of the Utilities serving this site. Utilities are shown for convenience only. The Owner and Owner's representatives assume no responsibility for improper locations or failure to show utility locations on the Drawings. Immediately repair utilities damaged during construction at Contractor's own expense.

B. Prior to commencing activities which may damage utilities, exercise appropriate care (by use of probes, hand excavation, and the like) to locate and prevent damage to existing utilities.

C. Contact locating services as needed to assure utility locations on site and in Right-of-Way.

1.13 CONFLICTS AND OMISSIONS IN SPECIFICATIONS

A. In the event of any inconsistency or ambiguity in the Bid and Contract Documents, the higher quality or quantity shall prevail and govern.

1.14 OWNER-FURNISHED PRODUCTS

A. General: Certain items, designated on the Drawings by the abbreviations “FOIC,” “FOIO” and “NIC” often require blocking, backing and accessory items necessary to complete the installations. This blocking, backing and accessory items for complete installations are requirements of this Project as further defined below.

B. Items, designated in the Drawings by the abbreviations “FOIO” meaning “Furnished by Owner, Installed by Owner” or “NIC” meaning “not in contract,” will be furnished and installed by the Owner.

1.15 MISCELLANEOUS REQUIREMENTS

A. Items include, but are not limited to:
   1. Maintaining and protecting pedestrian and vehicular access to and around existing facilities.
   2. Not unreasonably encumbering site with materials or equipment.
   3. Not loading structure with weight endangering it.
   4. Repairing to original conditions damage to existing paving or adjacent buildings or improvements.
   5. Maintaining existing “accessible” (“ADA”) routes.

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Contract Modification Procedures, including:

1. Supplemental Instructions.
2. Construction Change Authorization.
3. Documentation of Proposals and Claims.
4. Change Orders.
5. Distribution.

1.03 SUMMARY

A. Requirements Include:

1. Promptly implement change order and field order procedures.
    a. Provide full written data required to evaluate changes.
    b. Maintain detailed records of work done on a time-and-material/force account basis.
    c. Provide full documentation to Architect on request.

B. Related Requirements:

1. Coordinate related requirements specified in other parts of Project Manual including but not limited to the following:
    a. Change Orders / General Conditions (Vender Service Agreement), Article 7; Applications for Payment; Construction Schedules; Schedule of Values; Substitutions and Product Options; Project Record Documents.

2. Designate in writing the names of authorized members of Contractor's organizations who accept changes in the work and are responsible for informing other workers of the authorized changes.

3. Contractor agrees; Architect approves; Owner authorizes.

C. Definitions:

1. Change Order: County will provide a C hange Order form or Contractor can use Change Order Document AIA G701.

2. Architect's Supplemental Instructions: Work order, instructions, or interpretations, signed by Architect making minor changes in the work not involving a change in Contract Sum or Contract Time.

3. Construction Change Authorization: Written order to the Contractor, signed by Owner, Architect and Contractor amending Contract Documents as described. This order authorizes Contractor to proceed with a change altering Contract Sum or Contract Time and is to be included in a subsequent Change Order.

D. Preliminary Initiation / Changes:

1. Changes may be initiated by Owner and Architect through a Proposal Request submitted to Contractor. Request will include:

a. Detailed description of Change, Products, and location of change in Project.

b. Supplementary or revised Drawings and Specifications.

c. Projected time span for making change.

1) Statement as to whether overtime work is, or is not, authorized.

d. A specific period of time during which requested price will be considered valid.

e. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

E. Construction Change Authorization:

1. In lieu of Proposal Request, Architect may issue a construction change authorization for Contractor to proceed with a change for subsequent inclusion in Change Order.

2. Authorization describes work change additions and deletions, with attachments of revised Contract Documents to define details and designate any change in Contract Sum and Contract Time.

3. Owner and Architect will sign and date as authorization to proceed with changes. General Contractor cannot be paid for the work until it is incorporated into a change order and signed by all parties.

4. Contractor signs and dates to indicate agreement with terms.

F. Documentation of Proposals and Claims:

1. Support each lump sum proposal quotation, and each unit price (not previously established) with sufficient substantiating data.

2. On request provide additional data to support time and cost computations:

a. Labor Required; Hours, Hourly Rate.

b. Equipment Required.

c. Products Required.

1) Recommended source of purchase and unit cost.

2) Quantities required of each material.

3) Material unit costs and extended price.

d. Taxes, Insurance, and Bonds.

e. Documented credit for work deleted from Contract.

f. Overhead and Profit. Article 7 Supplementary Conditions.

g. Justification for any change in Contract Time.

3. Support each claim for additional costs, and time and material/force account work with documentation, as required for lump sum proposal. Include additional information:

a. Name of Owner's authorized agent who ordered work, and date of order.

b. Dates and times work was performed, and by whom.

c. Time record, summary of hours worked, and hourly rates paid.

d. Receipts and invoices for:

1) Equipment used, listing dates and times of use.

2) Products used, listing of quantities.

3) Subcontracts.

4. Document requests for substitutions for Products as specified.

G. Preparation of Change Orders:

1. Contractor will prepare Change Orders for Architect review.

2. Change Order Form: County provided or AIA Document G701.

3. Change Order provides accounting of any Contract Sum and Contract Time adjustment.

H. Lump Sum / Fixed Price Change Order:

1. Content of Change Orders will be based on, either:

a. Architect's Proposal Request and Contractor's responsible Proposal as mutually agreed between Owner and Contractor.

b. Contractor's Change Proposal, as recommended by Architect.

2. Proper signatures (dated) authorize you to proceed with changes.

3. Sign and date Change Order if you agree with terms.

I. Unit Price Change Order:

1. Content of Change Orders will be based on, either:

a. Definition of extent of required changes.

b. Contractor's Proposal for change, as approved with appropriate signatures.

c. Survey of completed work.

2. The amount of unit prices is to be:

a. Any stated in the Bid Form / Agreement.

b. Those mutually agreed upon between Owner and Contractor.

3. When Change Order quantities can be determined prior to start of work:

a. Appropriate listed persons will sign and date as authorization for you to proceed.

b. Sign and date Change Order to indicate your agreement with terms.

4. When quantities cannot be determined prior to start of work the following procedures will be followed:

a. Appropriately signed and issued construction Modification Proposal will authorize you to proceed on unit price basis and cite applicable unit prices.

b. At completion of change, Architect will determine cost of work based on unit prices and quantities used.

1) Submit documentation establishing any claims for Contract Time change.

c. Architect signs and dates the Change Order establishing change in Contract Sum and Contract Time.

d. All pertinent listed parties sign and date Change Order indicating their agreement.

J. Time and Material / Force Account Change Order / Construction Change Authorization:

1. Appropriately executed and signed Change Order authorizes you to proceed.

2. At completion of change, submit itemized accounting and supporting data as provided in Article "Documentation of Proposals and Claims" of this Section.

3. All concerned sign and date Change Order and/or Construction change authorization establishing change in Contract Sum and Contract Time.

4. Contractor signs and dates indicating his agreement.

K. Correlation with Contractor's Submittals:

1. Quarterly revise Schedule of Values and Request for Payment forms to record each change as a separate item of work. Record adjusted Contract Sum.

2. Monthly revise Construction Schedule reflecting each change in Contract Time.

    a. Revise sub schedules to show changes for other items of work affected by changes.

    b. Upon completion of work under Change Order, enter pertinent changes in Record Documents.

L. Distribution:

1. Send copies to all concerned parties.

    a. Change Orders:

        1) Upon authorization, Owner transmits one signed copy each to Contractor and Architect.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 29 00

SCHEDULE OF VALUES AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Administrative and Procedural Requirements for the Schedule of Values and Payment Applications.

1.03 SUBMITTAL

A. Submit the Schedule of Values in PDF format via email to the Architect for review.

1. Transmit under transmittal letter. Identify Project by title and by contract number.

1.04 FORMAT

A. Schedule of Values: Submit on AIA Document G703 or accepted equivalent.

B. For Specification Divisions 02 through 33 of the Project Manual follow the Table of Contents for minimum listing of schedule of values. Identify each line item by number and title of each specification section. Complex line items may be required to be listed in component parts of the line item.

1. List material and labor costs on separate line items.

C. For Specification Division 01 as a minimum include one line item for each of the following: mobilization, General Conditions, bonds and insurance, submittals, punch list correction, "record" drawings, O and M manuals, operation instructions and demobilization.

1. Refer to the General Conditions of the Contract for limitations on mobilization and closeout line items

1.05 REQUIREMENTS

A. These requirements are in addition to the requirements found in the General Conditions of the Contract.

B. Ten days prior to submission of first Application and Certificate for Payment, submit schedule of values for each project to Architect and Owner for review.

C. List installed value of each major item of Work and each subcontracted item of Work as a separate line item to serve as a basis for computing values for Progress Payments; as a minimum, provide at least one line item for each specification section. Round off values to nearest dollar.

D. List guarantees / warranties as separate line items for each type of work, such as roofing, painting, etc. Show the value of each of these on the Schedule of Values.

E. For each major subcontract or work of a specification section, list materials and installation as separate line items.

F. Where the value of a line item exceeds $50,000, break down item by major products or operations as separate line items.

G. Line-item listings shall each include a directly proportional amount of Contractor's overhead and profit.

H. For items on which payments will be requested for stored products, list subcontractor values for cost of stored products.

I. Include separate line item for Project Closeout. Cost for this item shall be either one-half of the Contractor’s mobilization cost or 5 percent of the total Contract Amount, whichever amount is greater.

1.06 APPLICATIONS FOR PAYMENT

A. Applications for Payment: Submit on AIA Document G702 or accepted equivalent.

B. Preparation of Application for Each Progress Payment:

1. Application Form:

a. Fill in required information.

1) Include Change Orders approved prior to Application Submittal date.

2) Fill in summary of dollar values to agree with respective total indicated on any continuation sheets.

3) Sign by responsible officer of Contract firm.

4) Sign all copies; no photocopies of signatures permitted.

5) Indicate for each line item, the percentage of completion as reflected in the dollar value of completed work.

2. Continuation Sheets:

a. Totally fill in all scheduled component work items. Show item number / scheduled dollar value / item / Schedule of Values.

b. Fill in dollar value in each column for each scheduled line item.

1) Round off values to nearest dollar. Tally Sheet.

2) If no work has been performed enter zero.

c. At end of continuation sheets, list each Change Order approved prior to submission date.

1) List by Change Order Number, and description, as for an original component item of work.

C. Post Addendums in field Specifications prior to first Progress Payment.

D. Substantiating Data for Final Payment:

1. When Owner or Architect requires substantiating data, submit suitable information, with cover letter.

2. Submit one copy of data and cover letter for each copy of Application.

E. Preparation of Application for Final Payment:

1. Fill in application form, as specified, for progress payment.

2. Use continuation-sheet for presenting final accounting statement, as specified: Project Closeout.

F. Submittal Procedure:

1. Submit Application for Payment at times stipulated in Agreement. Allow stipulated time for processing.

2. Number: One (1) copy of each Application, unless otherwise directed at Pre-construction Meeting.

3. When Architect finds Application properly completed and correct, they will transmit Payment Certificate to Owner.

4. If Architect finds application improperly or incorrectly executed, an annotated copy is returned for NEW SUBMITTAL.

5. Submit revised Progress Schedule with each Application for Payment.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Administrative and Procedural Requirements for:

1. Project Management.
2. Coordination.
3. Variations, Revisions and Clarifications.
4. Preconstruction Conferences.
5. Preinstallation Conferences.
6. Progress Meetings.
7. Coordination Meetings.

1.03 PROJECT MANAGEMENT

A. General: Provide direct, effective, experienced, cooperative, team-oriented, hands-on management of the Work including the daily construction operations on the Project site and that part of the Work that the Contractor chooses to delegate to Subcontractors / Suppliers.

1. Project management personnel shall be employees of the Contractor and shall not be subcontracted or delegated to others.
2. Project requires a fulltime project manager, superintendent, and project engineer.

B. Submittals:

1. Refer to Section 01 33 00 for submittal procedures.

C. Superintendent: Employ a Project Superintendent (different person than the Project Manager) housed in a temporary office on the Project site to oversee, direct, and manage the construction of the Work and including,

but not limited to, the following minimum characteristics and responsibilities:

1. A good communicator, organized, effective and capable of managing multiple tasks, difficult personalities, and tight deadlines without losing self- control or management effectiveness.

2. Trained, knowledgeable and experienced in job site safety and shall be responsible for managing safety issues on site in conformance with Federal, State and Local regulations.

3. Superintendent shall become thoroughly familiar with the requirements of the Contract Documents before work is started.

4. Responsible for executing the Work in conformance with the adopted Construction Schedule so that Project is completed on time.

5. Oversee and direct the work of Subcontractors and suppliers and confirm they are conforming to the requirements of the Contract Documents.

6. Jointly with the Project Manager, coordinate the Work of this Project as specified under “Coordination” in this section.

7. Responsible for determining the means and methods used to execute the Work.

8. Responsible for coordinating Work requiring independent inspection with the testing agency(s).

9. Responsible for managing and controlling the quality of the Work (including work by Subcontractors) in conformance with the Contract Documents and good construction practice.

10. Responsible for coordinating with the Authority having jurisdiction and Building Inspector(s) inspections and requirements.

11. Responsible for coordinating with utility providers.

12. Responsible for coordinating the final inspections required by Authorities having jurisdiction required for issuance of the Certificate of Occupancy.

13. Responsible for inspecting the work jointly with the Project manager and preparing the Contractor’s Punch List specified in Section 01 78 00.

14. Provide a Daily Report for each day on which work is performed on the job site on the Daily Report Form included at the end of this

section and submit to the Owner and Architect the next day.

D. Project Engineer: Employ a Project Engineer to support the work in the field including, but not limited to, the following minimum project management tasks:

1. Provide any task(s) required to support the construction of the Work and facilitate a planned, orderly and timely management of the Work.

2. Computer Skills: Experienced in using Microsoft Word, Excel, Adobe Acrobat (PDF files) e-mail, and whatever scheduling software is employed.

3. Submittal Review: Manage the submittal process specified in Section 01 33 00 so that submittals are reviewed and materials / equipment ordered and delivered so as to avoid delay in the Project Schedule.

    a. Review each submittal package for accuracy, completeness and conformance to the requirements of the Contract Documents.

    b. Review submittals for the quantity of items, field dimensions, coordination with adjacent work, and coordination of information.

    c. Apply Contractor's approval stamp to submittals before sending to Architect for review.

    d. Pick up and deliver submittals when required to meet ordering deadlines.

    e. Distribute submittals to Subcontractors and suppliers that have work that is affected by or requires coordination with the submittal.

4. Coordination: Jointly with the Project Superintendent, coordinate the Work of this Project as specified under "Coordination" in this section.

5. Field Engineering: Provide coordination drawing, field engineering and detailing services as required convert the design concept shown on the Drawings and specified into installation drawings required to construct the Work.

    a. Drawings may be hand drafted or drafted in AutoCAD / Revit.

    b. Maintain a file of completed drawings; enter pertinent data

onto as- built drawings.

c. Provide copy of drawings to Architect upon request.

6. Field Quality Control: Manage the various aspects of quality control for the Project including the following:

   a. Inspect materials and equipment daily as they are delivered on site for conformance to the requirements of the Contract Documents and reviewed submittals; provide written notification of any non- conforming items to Subcontractor / Supplier responsible with copy to the Architect.

   b. Inspect, monitor and document the work in progress for compliance with the Contract Documents; provide written notification of any non-conforming Work to Subcontractor / Supplier responsible with copy to the Architect.

   c. Monitor geotechnical engineer and testing agency inspections and reports, take appropriate action to resolve any non-conforming work.

   d. Coordinate and monitor site visits and inspections by manufacturer's representatives; take appropriate action to resolve any non-conforming work or coordination issues.

7. RFI Coordination: Manage the preparation and distribution of RFI including the following:

   a. Review field questions to determine if they require an RFI or field engineering / coordination by Contractor

   b. Assign consecutive number to each RFI issued.

   c. Maintain up to date log of each RFI issued, listing date sent, date answer received and who RFI was distributed to.

8. Preinstallation Conferences: Schedule and lead pre-installation conferences specified in various sections of the Specifications and any other work category that requires coordination or review of technical requirements.

   a. Keep minutes of the conference and send out meeting minutes to attendees.

   b. Document any decisions made that modify or amend the requirements of the Contract Documents.

9. As-Built Drawings: Manage the preparation of the as-built drawings specified in Section 01 78 00.
    a. Coordinate Subcontractor as-built data incorporation into the as- built drawing set.
    b. Maintain up-to-date as-built drawing set in the field office for review by Architect and Engineers upon request or at monthly payment request review.
10. Operation and Maintenance Manual Coordination: Manage the information collection and preparation of the operation and maintenance manuals specified in Section 01 78 00.
11. Systems Start-Up / Shakedown: Coordinate the connection and testing of equipment / systems installed in the Project.
    a. Confirm each Subcontractor's work is completed and final connections / adjustments made.
    b. Coordinate connection and testing by Subcontractor responsible for equipment / system.
    c. Confirm proper operation of equipment / system including each different option, accessory and feature after start-up.
    d. Prepare a list of deficiencies and uncompleted items for equipment / systems and distribute to the Subcontractors responsible with copy to the Architect; manage completion / correction in timely manner.
12. Punch List Review: Together with the Project Superintendent, inspect the completed Work and prepare the Contractor's Punch List of deficiencies in the Work specified in Section 01 78 00.
    a. Manage the timely completion of Contractor's Punch List items.
    b. Submit copy of Contractor's Punch List showing that items have been satisfactorily completed when notifying Architect that work is substantially complete and ready for Architect's punch list review.
    c. Manage the timely completion of Architect / Consultant Punch List items.
    d. Provide written notification to Architect when deficiencies noted in Architect / Consultant Punch List have been completed.

1.04 COORDINATION

A. General Coordination:

1. Coordinate the Work of trades and other sections to ensure that elements of the work are installed in their proper sequence, without the need for unplanned modifications to the structure, building systems or work already installed.

2. Provide direct coordination of the Work; do not delegate coordination responsibility to any subcontractor.

3. Plan out the Work in advance and anticipate the interrelationships between each subcontractor and their relationship to the overall Project.

4. Provide the leadership, direction and decisions necessary to prevent subcontractor and supplier problems and disputes from affecting the Project Schedule or the quality of the work.

5. Coordinate scheduling, submittals and work of the various sections of Specifications to assure proper, efficient and orderly sequence of preparation and installation of interdependent construction elements, with provisions for accommodating items installed later.

6. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

7. Coordinate completion and cleanup of Work of separate sections in preparation for Completion and for portions of the work designated for Owner's occupancy or use.

8. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

B. Site Utilities Coordination:

1. Coordinate utility connection work with each utility provider, including schedule, layout and any special requirements of the utility provider.

2. Coordinate the work of trades to assure proper fit and the proper operation of systems and equipment.

3. Coordinate space requirements and installation of utility work. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.

4. Lay out, work through and resolve any conflicts or problems involving site utility work that share the same space or require a special sequence of installation prior to starting any fabrication or installation. Provide coordination drawings wherever needed to maintain control of the installation in areas involving numerous trades.
5. Leave adequate space for maintenance access, by a normal size maintenance man, to equipment and items without the need for special equipment or removal of items that block access.

1.05 VARIATIONS, REVISIONS AND CLARIFICATIONS

A. Variations, revisions and clarifications to the work not involving an adjustment to the Contract Sum or Contract Time will be confirmed in writing. These written confirmations may be included in the Project minutes, memos to the Contractor and Owner, e-mail correspondence, or in answers to written Requests for Information (RFI).

B. Requests for Information (RFI) shall be submitted on the RFI form attached at the end of this Section. This form must be completely filled out as applicable by the Contractor prior to submission. Submit RFI via e-mail.

C. Requests For Information (RFI) shall be limited to a single subject and discipline, do not submit RFI with multiple unrelated questions.

D. Adhere to the requirements of the General Conditions of the Contract for any variations, revisions and / or clarification to the work that the Contractor believes will involve a change in the Contract Sum or Contract Time.

E. For Shop Drawing variations conform to requirements of the General Conditions of the Contract and Section 01 33 00.

1.06 PRECONSTRUCTION CONFERENCE

A. Refer to Section 01 31 19.

1.07 PROGRESS MEETINGS

A. Refer to Section 01 31 19.

1.08 PREINSTALLATION CONFERENCES

A. Refer to Section 01 31 19.

1.09 COORDINATION MEETINGS

A. Refer to Section 01 31 19.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

0.0 CUTTING AND PATCHING

.Execute cutting and patching Work and structural reinforcing in a manner to prevent damage to other Work and to provide proper surfaces for installation of repairs, penetrations through surfaces, or other items.

A. For all new Work employ original installer or fabricator to perform cutting and patching for weather exposed or moisture resistance elements, fireproofing, and finished surfaces exposed to view.

B. Provide cutting and patching for all existing work, where mechanical and electrical utilities or similar services extend beyond limits of work for new construction, to match existing.

C. General: Provide and be responsible for all cutting, fitting, and patching required to complete the Work, or to:

1. Make its several parts fit together and to provide for installation of ill-timed Work.
2. Uncover portions of Work to provide for installation of ill-timed Work.
3. Remove and replace defective Work.
4. Remove and replace Work not conforming to Contract Document requirements.
5. Remove samples of installed Work as specified for testing.
6. Provide routine penetrations on non-structural surfaces for installation of piping.

D. Project Conditions:
1. Inspect existing conditions including elements subject to damage or movement during cutting and patching.
2. After uncovering Work, inspect conditions affecting installation of products or performance of Work.
3. Report unsatisfactory or questionable conditions to Architect in writing. Do not proceed with Work until Architect provides further instructions.

END OF SECTION

REQUEST FOR INFORMATION

TO: Alana, Buick & Bers
300 W Elliott Ave West, Suite 250
Seattle, WA 98119

ATTN: _____ RFI # _____

PROJECT NAME: _____PROJECT NUMBER: _____

REFERENCE DRAWING OR SPEC: _____

SUBJECT OF RFI: _____

DESCRIPTION:

CONTRACTOR: _____ RESPONSE REQUESTED BY (DATE): _____

BY: _____ DATE: _____

RESPONSE:

A/E: _____ BY: _____ DATE: _____

This is not an authorization to proceed with work involving additional cost and / or time. Contractor shall obtain approval / authorization *prior to* proceeding with this work if the response in this RFI will result in additional cost and / or time.

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Project Meetings, including:

1. Preconstruction Conferences.

2. Progress Meetings.

3. Preinstallation Conferences.

4. Coordination Meetings.

1.03 PRECONSTRUCTION CONFERENCE

A. Schedule a preconstruction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 10 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including the following:

1. Designation of personnel representing the parties in Contract and the Architect.

2. Discussion of list of Subcontractors, list of Products, schedule of values and progress schedule.

3. Procedures and processing of field decisions, submittals, substitutions,

applications for payments, proposal request, Change Orders and Contract closeout procedures.

4. Scheduling.

5. Coordination with Owner.

6. Testing and inspection coordination.

7. Procedures for maintaining record documents.

8. Requirements for start-up of equipment.

9. Inspection and acceptance of equipment put into service during construction period.

10. Contractor Safety.

1.04 PROGRESS MEETINGS

A. Conduct progress meetings at the Project Sites at regular intervals. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and the Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind 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.

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

a. Approval of minutes of previous meetings.

b. Review of Work progress since previous meeting.

c. Review work planned.

d. Review Project Schedule (4-week and Master CPM Schedule).

e. Review submittal schedules; expedite as required.

f. Review of Request for Information (RFI).

g. Review deliveries.

h. Review proposed changes.

i. Review technical and administrative questions / concerns from Contractor, Owner, Architect, Consultants.

j. Review As-Built Drawings.

k. Field Observations.

D. Four-Week Schedule:

1. Prior to each meeting, prepare a four (4) week schedule showing work completed during the previous week, work that is in progress for the current week and work planned for the following two weeks. This four-week schedule, which is revised weekly by the Contractor, will be presented by the Contractor at the progress meeting and a copy will be given to the Architect and to the Owner at that time.

2. In the event that a progress meeting is not scheduled for the current week, prepare the 4-week schedule and forward it to the Architect in the same week.

E. Reporting:

1. Architect will administer the meeting, record decisions and actions from the meeting and send copies of meeting notes to Owner and Contractor.

2. The Contractor will be responsible to distribute copies to his field representative and to Subcontractors.

3. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.05 PREINSTALLATION CONFERENCES

A. When required in individual specification section or when Owner, Architect or Contractor determines the need, the Contractor shall convene a pre-installation conference at work site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Owner and Architect seven calendar days in advance of meeting date.

D. Prepare agenda, preside at conference, record minutes and distribute copies within two days after conference to participants.

E. Review conditions of installation, preparation and installation procedures, and coordination with related work.

F. Schedule pre-installation conferences to occur immediately before or after the agreed on day / time for progress meetings.

1.06 COORDINATION MEETINGS

A. Conduct project coordination meetings at regular intervals convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special preinstallation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

C. 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

SECTION 01 32 00

CONSTRUCTION SCHEDULES AND REPORTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Progress Schedules and Reports, including:

1. Submittal Procedures.

2. Contractor's Construction Schedule.

3. Submittal Schedule.

4. Special Reports.

1.03 SUBMITTALS

A. Prepare and submit proposed Construction Schedule to Owner and Architect as soon as possible after Notice to Proceed and prior to first Application for Payment.

1. Submit schedule in both paper and digital computer formats acceptable to the Owner.

B. Submit updated schedule with each Application for Payment or more frequent if required.

C. Applications for Payment will not be processed until schedule is in conformance with requirements of the specifications.

1.04 DISTRIBUTION

A. Distribute copies of Construction Schedule to project site file, subcontractors, suppliers, Owner, Architect and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

C. Construction Office: Post a copy of the current Construction Schedule on the wall in the construction office where the job meetings will be held; suspend a moveable vertical line on the current date to facilitate review and discussion of

schedule progress and issues at weekly job meetings.

1.05 GENERAL

A. The intent of the Construction Schedule is to assist the Contractor in planning and execution of the Work in a timely manner and assist the Contractor, Architect and Owner in monitoring the construction progress for the purpose of coordination, communication, evaluation of Applications and Certificates for Payment, and evaluation of time extension requests.

B. This section supplements the General Conditions and Special Conditions with additional schedule requirements, where conflicts exist, the most restrictive requirement shall govern.

C. Any plan by the Contractor to complete the Work or any part of the Work earlier than any contract required milestone or specific completion date shall not be construed as creating any responsibility or liability for the Owner or Architect should their actions, or lack thereof, prevent the Contractor from achieving the planned early completion. The Owner and Architect shall not be liable to the Contractor for any costs or other damages if the Contractor is unable to achieve early completion of the Work before a milestone or completion date.

D. Float Time: Float time is the amount of time between the earliest start date and the latest start date, or between the earliest finish date and the latest finish date of a chain of activities on the CPM Schedule. Float time belongs to the Project and is not for the exclusive use or benefit of either the Contractor or the Owner; float time may be used by either the Contractor or Owner for offsetting delays. Use of float suppression techniques such as preferential sequencing, special lead / lag logic restraints, zero total or free float constraints, extended activity times or imposed dates shall be cause for rejection of the Construction Schedule or any revisions or updates.

E. Scheduling Personnel: Contractor’s shall employ scheduling personnel or consultant with a minimum of 5 years of experience using the proposed scheduling software on projects of similar size and scope. If requested, provide a list of scheduling experience with copies of the schedules.

F. Schedule shall anticipate and include sufficient float time for weather dependent work tasks to allow for any delays due to normal inclement weather (defined as any inclement weather within the ten-year average of accumulated record mean values from climatological data compiled by the National Oceanic and Atmospheric Administration (NOAA), for the locale of the Project, over the full duration of the Contract Time).

1.06 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Construction Schedule:

1. Schedule Methodology: Critical Path Method (CPM) for the planning, scheduling and reporting of the work required by this contract.

2. Schedule Type: Precedence Diagramming Method (PDM).

3. Acceptable Software Programs:

   a. Microsoft Project.

   b. Primavera Project Planner.

4. Schedule Sheet Size: 11-inches x 17-inches preferred if readable, no larger than 24-inches x 36-inches.

5. Schedule Contents: Schedule shall contain the following information:

   a. Task ID number (numbered in ascending order, (e.g. *1, 2, 3, 4,* etc.)

   b. Task Name (activity), provide a two or three word description of each activity; identify each activity with the applicable Specification Section number (e.g. *Carpet – 09 68 00)*.

   c. Task Duration (e.g. *10 days*).

   d. Early Task Start Date (e.g. *Mon 7/22/20*).

   e. Late Task Start Date (e.g. *Mon 7/29/20*).

   f. Early Task Finish Date (e.g. *Mon 7/22/20*).

   g. Late Task Finish Date (e.g. *Mon 7/29/20*).

   h. Float Time (e.g. *7 days).*

   i. Predecessor Tasks.

   j. Successor Tasks.

   k. Calendar: List the Weeks, Months and Year(s) across top of each page of the schedule. Show a graphic task duration bar indicating the start and finish date corresponding to the calendar for each task.

B. Schedule Requirements: Include the following requirements:

1. List every work activity required to complete the Work in the Task Name column and include the following:

   a. Task Name shall describe individual work activities in a defined area of the Project, not multiple work activities for the entire project, e.g. *underslab plumbing rough-in – west wing* instead of *plumbing* for the entire project. Provide as many activities as necessary to clearly show how the Project will be constructed

within the time allowed.

b. Include completion and milestone dates as specified in Section 01 11 00.

c. Include dates for submission of each submittal to Architect for review as required to assure materials / products / systems will be on site when required to allow conformance to the Project completion and milestone dates. When Architect's review time is critical to the Project completion schedule, identify the review return dates in the schedule.

d. Indicate date required for selection of colors and finishes as applicable.

e. Include product delivery dates, including those furnished and / or installed by separate contractors or the Owner.

f. Show dates when application for separate permits (i.e. fire alarm, fire sprinkler, etc.) will be made and when permit will be received.

g. Include dates for Contractor's Punch List review and Contractor's completion of punchlist items.

h. Include dates for Architect's Punch List review and Contractor's completion of punchlist items.

i. Show dates for pre-cover inspections and final inspections required by authorities having jurisdiction.

j. Include dates for preparation and submission of operation and maintenance manuals and project record drawings (minimum of 30 days before final completion). Show Architect's review time and resubmittal of corrected manuals and drawings.

2. Keep individual tasks listed to short durations with limited scope of work (one to two weeks maximum) unless the task is dependent on several activities of longer duration.

3. Each task shall have a corresponding time duration bar to the right of the columns graphically showing the duration of each activity on the calendar.

4. Show complete sequence of construction by activity, identifying work of separate contractors or Owner required to complete the Work.

5. Graphically indicate each task that is on the critical path for completion (by color or pattern) on the task duration bar. Show the interrelationship of each critical path task to other critical path tasks by drawing arrows

between the task duration bar finish and start points.

6. Include sufficient additional float time in the duration of those specific activities that are weather dependent (such as: underground utilities, pavement, painting, etc.) to prevent delaying critical path activities due to normal inclement weather based on the time of year the tasks are being accomplished and the corresponding historic weather data averages for those dates.

    a. Weather related float time shall be calculated after late task finish date and shall be included in the critical path time calculation.

    b. Identify additional weather-related time allowed in the duration or include as a separate task directly under the affected work task.

1.07 UPDATING SCHEDULES

A. Update the Construction Schedules monthly to reflect actual work activity dates accomplished and any revised work activity dates.

B. Maintain Construction Schedules to record actual start and finish dates of activities as they are completed.

C. Indicate progress of each activity at the time of the revision date. Update diagrams to graphically depict current status of Work.

D. Indicate revision date on revised schedule.

E. Show changes occurring since previous Schedule submission such as:

1. Any major changes in scope;

2. Activities modified since previous submission;

3. Revised projections for progress and completion, as applicable;

4. Any other identifiable changes.

F. Provide narrative report as needed to define:

1. Problem areas; anticipated delays; and impact on schedule.

2. Corrective action to be taken by the Contractor to get the Project back on schedule. This report will define how and when the Contractor will accomplish this.

1.08 RECOVERY SCHEDULE

A. Whenever completion of any critical path activity(s) extends beyond its late

finish date or in any way jeopardizes timely completion of a Contract milestone date or completion date the Contractor shall prepare a recovery schedule showing how work activity start and finish dates will be revised to allow the completion of milestone and completion dates on schedule.

B. Recovery schedule shall be prepared as soon as possible after discovery of any delay affecting critical path activity(s), but not longer than 7 days.

1.09 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 2 days of the date required for submittal of the Contractor's Construction Schedule.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values and the list of products as well as the Contractor's Construction Schedule.

B. Prepare the schedule in chronological order. Provide the following information:

1. Scheduled date for the first submittal.

2. Related Section number.

3. Submittal category.

4. Name of the subcontractor.

5. Description of the part of the Work covered.

6. Scheduled date for resubmittal.

7. Scheduled date for the Architect final release or approval.

C. Distribution: Following the Architect’s response to the initial submittal, print and distribute copies to the Architect, Owner’s representatives, subcontractors, and other parties required to comply with submittal dates indicated.

1. Post copies in the Project meeting room and temporary field office.

2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

E. Field Correction Reports: When the need to take corrective action that requires

a departure from the Contract Documents arises, prepare a detailed report. Include a statement describing the problem and recommended changes. Indicate reasons the Contract Documents cannot be followed. Submit a copy to the Architect immediately.

1.10 SPECIAL REPORTS

A. General: Submit special reports directly to the Owner's representatives within one day of an occurrence. Submit a copy to the Architect and other parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at the site, prepare, and submit a special report. List the chain of events, persons participating, response by the Contractor's personnel, an evaluation of the results or effects and similar pertinent information. Advise the Owner's representatives in advance when such events are known or predictable.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Construction photography of work-in-progress and concealed as-built construction.

1.03 GENERAL

A. Provide photographs taken from locations coordinated with Owner's Representative.

B. Photographer: Experienced in taking construction photography.

C. Equipment: Photos shall be taken with digital camera equipment capable of meeting image size requirements listed below. Utilize a full range of lenses including wide angle and telephoto as appropriate.

D. Video images may be acceptable for certain operations. Confirm with Project Manager.

PART 2 - PRODUCTS

2.01 CONSTRUCTION PHOTOGRAPHS

A. Provide CD's containing photographs of construction progress on a monthly schedule.

B. Provide photographs in the form listed below.

2.02 PHOTOGRAPHIC SUBMITTALS

A. Photographs shall be provided on a compact disc (CD) or via a method agreed to by the Architect, Owner and Contractor.

B. Minimum JPEG image size shall be 1280 X 960 pixels.

C. Photographs shall be representative of project progress, showing major work and critical concealed conditions.

D. Label photograph files with project name and date of submittal. Each photograph shall be dated, labeled and be provided with a brief description identifying the location and direction the photo was taken. Date stamp using month / date / year format.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

A. Take construction photographs beginning at Notice to Proceed and continuing through Substantial Completion.

B. Take minimum of 50 photographs each month. Take additional photographs as needed to fully document the Work. Document the following with photographs:

1. As-built concealed conditions that may benefit the Owner's future maintenance and operations activities. Take photographs (with a reference point) prior to cover or concealment.

2. Wall cavity utility routing prior to cover, take sequential photos of each length of framed wall after mechanical and electrical rough-in is completed.

3. Above ceiling installation after ceiling support system installed, but prior to cover.

4. Exterior elevations from each side / facet of building, take a series of photos from the same location each month.

5. Site work, take a series of photos from the same location each week.

C. The photograph record described above shall be considered minimum and shall not be deemed to limit the quantity or quality of the photographic record.

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Administrative and Procedural Requirements for Project Submittals.

1.03 ADMINISTRATIVE SUBMITTALS

A. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and Payment Bonds.
4. Insurance Certificates.
5. List of Subcontractors.

1.04 SUBMITTAL PROCEDURES

A. Schedule submittals to expedite the Project. Transmit submittals in accordance with Construction Schedule and in such sequence to avoid delay in the Work. Coordinate submission of related items with schedule.

B. Electronic Submittals – Format: Shop Drawings, Product Data, Certificates, Warranties and any similar submittals, other than physical samples, shall be provided as digital submittals in PDF format suitable for sending via electronic mail or downloaded from internet file transfer website.

1. Submittal shall be submitted as one PDF and each item bookmarked to allow for efficient review.
2. Organize submittals per specification section. Include all items listed in each specification section to facilitate one review by the Design team per specification section.

3. PDF security permissions shall be formatted to allow printing, reviewing and editing functions by Architect and Owner using any PDF compatible computer program.

4. When electronic submittals are required to be accompanied by a physical sample, the submittal will not be returned until both the electronic submittal and physical sample are reviewed.

C. Contractor Shall:

1. Review submittal for completeness before sending to Architect for review. Submittal shall have each of the items noted under the Submittals section in each specification section (Product Data, Drawings, Samples, Certifications, etc.).

   a. Incomplete submittals will be returned “Not Reviewed” by Architect.

2. Review and approve each submittal prior to submission to Architect.

3. Include a review priority for Architect if multiple and / or large submittals are transmitted to Architect in the same week.

4. Reproduce and distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions. Pay all costs for reproduction, distribution, and materials.

5. Coordinate submittals into logical groupings to facilitate inter-relation of the several items:

   a. Finishes which involve Architect selection of colors, textures, or patterns.

   b. Associated items which require correlation for efficient function or for installation.

6. Identify, in writing, variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.

7. Accompany submittals with transmittal letter containing:

   a. Date.

   b. Project title and number.

   c. Contractor's name and address.

   d. Number of copies of Shop Drawings, Product Data and Samples submitted.

e. Identification of submittal as it relates to:

1) Subcontractor / Supplier / Manufacturer:

Name.

Address.

Telephone number. Representative's name.

2) Detail number and location in Construction Documents.

3) Specification reference number and paragraph.

4) Applicable Standards.

5) Finishes.

6) Identification of deviations from Contract Documents.

D. Additional Information Required:

1. Relation to adjacent structure or materials.

2. Fabrication methods, assembly, special installation requirements, accessories, fasteners and other pertinent information.

3. Field dimensions, clearly identified.

4. Coordination with other trades. Stamped and signed by affected trades.

E. Distribution:

1. Send submittals to Architect via electronic mail or from internet file transfer website.

2. Architect will return reviewed submittals to Contractor and Owner via electronic mail or Architect's internet file transfer system.

3. Send copy of Architect reviewed submittal to Subcontractors / Suppliers.

1.05 SUBCONTRACTOR AND SUPPLIER LIST

A. Prior to submission of First Application for Payment, submit complete list of subcontractors and suppliers to be used for the Work. Provide specification section identification number, addresses and telephone numbers for each listed subcontractor and supplier providing materials.

1.06 SHOP DRAWINGS

A. Present in clear and thorough manner. Title each drawing with Project name

and number; identify each element of drawings by reference to sheet number and detail, schedule, or room number of Contract Documents.

B. Identify field dimensions; show relation to adjacent or critical features or Work or products.

C. Do not submit freehand drawings or hand drafted drawings.

D. Shop Drawings requiring Code Agency Approval: Submit on format and media required by Approval Agency. Include information required by Project Documents and Approval Agency.

1.07 PRODUCT DATA

A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.

1.08 SAMPLES

A. Submit two samples of the specified color and texture for each product unless specified otherwise in individual specification sections; samples will be retained by Architect.

B. Where a specific color has not been specified, submit full range of manufacturer's standard and special finishes except when more restrictive requirements are specified, indicating colors, textures and patterns, for Architect selection.

C. Label each sample with identification required for transmittal letter.

D. Field samples are to be maintained at the site of the Work and are to be removed after substantial completion unless directed otherwise.

1.09 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification sections, submit manufacturer's certificate to Architect for review.

B. Indicate material / product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits and certifications as appropriate.

C. Certificates may be recent or previous test results on material / product, but must be acceptable to Architect / Engineer.

1.10 CALCULATIONS

A. When specified in individual specification sections, submit calculations to Architect for review.

1.11 CONTRACTOR REVIEW

A. Coordinate submittals with requirements of the Work and Contract Documents.

B. Apply Contractor's stamp with signature. The submittal signed by the Contractor certifies that the Contractor has reviewed the submittal for accuracy, completeness and compliance with the Contract Documents. It also certifies that the Contractor has verified products required, field dimensions, adjacent construction work, and coordination of information, in accordance with the requirements of the Work and Contract Documents. Submittals without Contractor's stamp and signature are rejected. Notify Architect in writing at time of submittal, of any deviations from requirements of Contract Documents.

1.12 RESUBMITTALS

A. Revise and resubmit submittals as required, identify changes made since previous submittal.

B. Shop Drawings, Product Data and Calculations:

1. Revise initial drawings, data or calculations and resubmit as specified for the initial submittal.

2. Indicate any changes which have been made including those requested by the Architect.

C. Samples: Submit new samples as required.

D. Architect reserves the right to charge the Contractor for reviewing non-responsive resubmittals.

1.13 ARCHITECT REVIEW

A. Architect or their consultant(s) will review shop drawings, product data, calculations and samples and return submittals to Contractor.

B. Architect’s review is qualified by the following language included on the review stamp: “This review is only for general conformance with design concept of the Project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. Contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination

of his or her Work with that of all other trades; and for performing all work in a safe and satisfactory manner".

1. Any action shown is subject to Contract Document's requirements. Architect will mark the review submittal in one of the following boxes on review stamp:

   - ❑ Reviewed
   - ❑ Furnish as Corrected
   - ❑ Rejected
   - ❑ Revise and Resubmit
   - ❑ Submit Specified Item

C. Architect / Engineer review of individual or separate items does not constitute review of assembly in which it functions.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Regulatory Requirements.

1.03 APPLICABLE CODES AND STANDARDS

A. Any specific reference in the Specifications to codes, regulations, reference standards, manufacturer's instructions or requirements of regulatory agencies shall mean the latest printed edition of each in effect at the date of submission of bids unless the document is shown dated.

B. Perform the Work in conformance with the applicable requirements of all regulatory agencies including, but not limited to, the following:

1. International Building Code (IBC).
2. National Electrical Code (NEC).
3. Uniform Plumbing Code (UPC).
4. International Mechanical Code (IMC).
5. Washington State Non-Residential Energy Code.
6. Washington State Ventilation and Indoor Air Quality Code.
7. Washington State Regulations for Barrier-Free Facilities.
8. Americans with Disabilities Act (ADA).

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. References, including:

1. Abbreviations.

2. Symbols.

3. Definitions.

1.03 ABBREVIATIONS

A. The following abbreviations of organizations may be used in the Contract Documents.

AAMA	Architectural Aluminum Manufacturer's Association
ACI	American Concrete Institute
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWS	American Welding Society

AWI	Architectural Woodwork Institute
BHMA	Builder's Hardware Manufacturers Association
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
CS	U.S. Commercial Standard
DHI	Door and Hardware Institute
FGMA	Flat Glass Marketing Association
FM	Factory Mutual System
FS	Federal Specification
GA	Gypsum Association
IBC	International Building Code
ICC	International Code Council
MLSFA	Metal Lath / Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association; National Forest Products Association
NWMA	National Woodwork Manufacturers' Association
NWWDA	National Wood Window and Door Association
PCI	Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PS	U.S. Product Standard
SDI	Steel Deck Institute; Steel Door Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.

SSPC	Steel Structures Painting Council
TCA	Tile Council of America
TPI	Truss Plate Institute
UL	Underwriters' Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
WABO	Washington Association of Building Officials
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WWPA	Western Wood Products Association

1. Additional abbreviations, used only on the Drawings, are listed thereon.

1.04 SYMBOLS

A. Symbols, used only on the Drawings, are shown thereon.

1.05 DEFINITIONS

A. Terms used on the Drawings or in the Specifications in addition to those shown in General Conditions shall have the following meanings:

TERM	MEANING
As Directed	"By the Architect"
As Required	"By Code; by good building practice; by the condition prevailing; by Contract Documents; by Owner, or by Architect"
As Selected	"By Architect"
Equal	In the opinion of the Architect. The burden of proof of equality is the responsibility of the Contractor.
Furnish	"Supply and deliver to the Project ready for installation and in operable condition."
Install	"Incorporate in the Work in final position, complete, anchored, connected, and in operable condition."
NIC	Not in Contract

Project	Total construction of which Work performed under the Contract Documents may be the whole or a part.
Provide	"Furnish and install complete." When neither "furnish", "install", nor "provide" is stated, "provide" is implied.
Shown	"As indicated on the Drawings"
Specified	"As written in the Project Manual"

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Administrative and Procedural Requirements for Project Quality Control.

1.03 REFERENCES

A. Conform to the requirements of the referenced standards referred to in individual specification sections. Reference standards shall be the edition current as of the date of the Contract Documents.

B. Obtain copies of reference standards that govern work performed on site.

C. Should specified reference standards conflict with Contract Documents, the most stringent and restrictive requirement shall prevail except where Architect / Engineer provides other direction; request clarification from Architect before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

E. Americans with Disabilities Act (ADA).

F. ICC / ANSI A117.1 – Accessible and Usable Buildings and Facilities.

1.04 CONTRACTOR'S QUALITY ASSURANCE / CONTROL OF CONSTRUCTION

A. Employ / assign quality control personnel to monitor the work of this project for conformance to the requirements of the Contract Documents and to good construction practices.

1. Prior to starting their work, review the scope of work, performance requirements, materials and workmanship requirements with each trade and subcontractor.

2. Review materials when delivered to the site for conformance to the Contract Documents and submittals.

3. Monitor work in progress for conformance to the Contract Documents and submittals.

B. Contractor is solely responsible for managing and controlling the quality of the work and conformance with the requirements of the Contract Documents.

C. Monitor quality control over suppliers, manufacturers, products, services, site conditions and workmanship, to produce Work of specified quality.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Work shall be performed by trained and experienced workers qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

G. Inspections and reports issued by special inspector or testing laboratory do not relieve the Contractor from his responsibility to construct Work in conformance with the requirements of the Contract Documents.

H. Contractor is responsible to review and confirm that substrate construction, site conditions and work by others complies with requirements of Contract Documents and manufacturer's requirements for subsequent work prior to installation or cover.

1.05 ACCESSIBILITY REQUIREMENTS

A. Accessibility Requirements: The accessibility requirements shown on the Drawings are required for conformance with the Americans with Disabilities Act (ADA) and ICC / ANSI A117.1. Strict conformance with the accessibility requirements shown on the Drawings is required for this project; non-conforming work will require correction at Contractor's expense.

1. A copy of ICC / ANSI A117.1 shall be kept on the jobsite for reference during construction and reviewed to provide a full understanding of each accessible design requirement.

2. Construction Tolerances: Typical construction tolerances common to the construction industry are not acknowledged or permitted by the Americans with Disabilities Act (ADA) and ICC / ANSI A117.1. Therefore, Work must be constructed within the strict accessibility requirements without any allowable construction tolerances.

B. Submittal Review: Review submittals for conformance with the accessibility requirements of ICC / ANSI A117.1 shown on the Drawings; mark up submittals that have incorrect or missing accessibility requirements.

C. Review with Workers: Review the accessibility requirements of ICC / ANSI

A117.1 and the Drawings with workers performing work that is required to conform to the accessibility requirements of ICC / ANSI A117.1.

D. Monitoring: Monitor the work of this project for compliance with the accessibility requirements of ICC / ANSI A117 shown on the Drawings.

E. Inspection: Inspect the completed work that is required to conform to accessibility requirements for conformance with ICC / ANSI A117.1. Inspection shall require accurate measurements to confirm that dimensions, slopes, and relationships shown on the Drawings have been constructed in accordance with accessibility requirements.

1.06 FIELD SAMPLES

A. Install field samples at the site as required by individual specifications sections for review.

B. Acceptable samples represent the quality level of the Work.

1.07 MOCK-UP

A. Provide where specified.

B. Assemble and install specified items, with specified attachment and anchorage devices, flashings, seals, and finishes. Install complete full-scale mock-up of assembly at project site.

C. Where mock-up is not a permanent part of the construction, remove at agreed upon time. Do not remove mock-up without Architect's approval.

1.08 INSPECTION AND TESTING AGENCY SERVICES

A. Owner will appoint, employ, and pay for services of an independent inspection and testing agency to perform inspection and testing.

B. The inspection and testing agency will perform inspections, tests and other services specified in individual specification sections, as noted on the Structural Drawings, and as required by the Owner or Architect.

C. Reports will be submitted by the inspection and testing agency to the Authority Having Jurisdiction, Architect, Engineer, Contractor, and Owner, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

D. Contractor's Responsibilities:

1. Cooperate with inspection and testing agency personnel and facilitate their inspection / testing work on the project site.
2. Coordinate the work and inspection / testing schedule directly with inspection and testing agency.

3. Notify inspection and testing agency and Architect 24 hours minimum prior to expected time for operations requiring inspection / testing.

4. Furnish inspection and testing agency with reviewed submittals, including concrete design mix, etc.

5. Furnish safe access to the work requiring testing / inspection, samples of materials, equipment, tools, storage, electrical power, and assistance as requested.

6. Make arrangements with inspection and testing agency and pay for additional samples and tests required for Contractor's use.

7. Correct / replace any work found by the inspection and testing agency to be not in conformance with the Contract Documents.

E. Site visits and retesting required because of scheduling problems caused by the Contractor and / or non-conformance to specified requirements shall be performed by the same inspection and testing agency. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Sum
/ Price.

1.09 MANUFACTURER'S FIELD SERVICES AND REPORTS

A. When specified in individual specification sections or when required by field installation problems, questions or concerns, require material or product suppliers or manufacturers to provide qualified staff personnel to visit the jobsite and provide technical consultation, observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance of equipment as applicable, and to initiate instructions.

B. Representative to submit written report to Architect describing testing observations and recommendations. Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions shall also be included.

C. Submit report in duplicate within 30 calendar days of observation to Architect for review.

1.10 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's installation / assembly instructions in full detail, including each step-in sequence.

B. Substrates, Site Conditions and Work By Others shall conform to manufacturer's requirements:

1. Inspect substrate, site conditions and work by others for conformance to manufacturer's requirements for material and condition prior to

starting any work.

2. Do not start work if substrate construction, site conditions or work by others does not comply with manufacturer's recommendations; report any problems to Contractor and Architect.

3. Start of work / installation indicates installer's acceptance of substrate, site conditions and work by others as meeting manufacturer's requirements.

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.11 MANUFACTURER'S CERTIFICATES

A. When required in individual specification sections, submit manufacturer's certificate. Refer to Section 01 33 00, paragraph entitled "Manufacturer's Certificates."

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 55 26

TRAFFIC CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Temporary Traffic Control.

1.03 REFERENCES

A. References shall be the edition current as of the date of the Contract Documents.

B. Authority Having Jurisdiction (AHJ): City of Mount Vernon.

C. Washington Department of Transportation (WSDOT):

1. WSDOT Specification: Standard Specification for Road, Bridge, and Municipal Construction. (Delete Measurement and Payment Provisions.)

2. WSDOT Standard Plans for Road and Bridge and Municipal Construction: Standard plans.

3. WSDOT Design Manual, M22-01.

4. WSDOT Work Zone Traffic Control Guidelines, M55-44.

D. U.S. Department of Transportation, Federal Highway Administration (FHWA):

1. Manual on Uniform Traffic Control Devices (MUTCD)

2. FHWA Final Rule on 23 CFR 630 Subpart J.

E. United States Access Board; Public Right of Way Accessibility Guidelines (PROWAG).

F. United States Access Board; ADA Accessibility Guideline (ADAAG).

G. American Traffic Safety Services Association (ATSSA); ATSSA Quality

Guidelines for Work Zone Traffic Control Devices.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for submittal procedures.

B. Traffic Control Plan: In accordance with these documents, WSDOT Standard Specifications, or the authorities having jurisdictions (AHJ)'s Standard Specifications.

1. The Traffic Control Plan shall provide description of devices and management to be used during working and non-working periods. Include durations (days and times) of control plans. Plans shall be submitted for approval a minimum of [30] days prior to the implementation of the plans to allow time for review and approval by the authorities having jurisdiction

C. Provide Qualifications for Traffic Control Manager (TCM) and Traffic Control Supervisor (TCS).

1.05 QUALITY ASSURANCE

A. Qualifications for the Traffic Control Manager: As specified in WSDOT Standard Specifications Section 1-10.2(1)A.

B. Qualifications for the Traffic Control Supervisor: As specified in WSDOT Standard Specifications Section 1-10.2(1)B.

C. The TCS and the TCM shall have valid certificates as "Traffic Control Supervisors" as issued by the Evergreen Safety Council, The Northwest Laborers-Employers Training Trust, The American Traffic Safety Services Association, or approved equal.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Traffic Control Devices:

1. Provide or construct traffic control devices, including temporary concrete barriers and temporary construction fencing, in conformance with applicable jurisdiction specifications and requirements. Include descriptions of traffic control devices in the Traffic Control Plan. The condition of signs and traffic control devices shall be new or "acceptable" as defined in the ATSSA Quality Guidelines for Work Zone Traffic Control Devices, and will be accepted based on a visual inspection by the Traffic Control Supervisor.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION

A. For temporary traffic control of streets, roadways, and pedestrian and bicycle facilities that are to be owned or maintained by the AHJ, perform work described in this section in conformance with the applicable requirements of that jurisdiction.

B. Work with the responsible jurisdiction to coordinate necessary signal changes if required by the traffic control plan. Traffic signals shall only be countermanded by a uniformed police officer.

C. Identify the use of flaggers and Police staff for traffic control in the Traffic Control Plan and obtain prior approval from the AHJ. Employ flaggers whenever trucks enter onto a city street, including at vehicle access gates to the construction work Site, to prevent conflicts with vehicles, cyclists and pedestrians. Minimize roadway, lane and sidewalk closures. Limit lane and roadway closures to non- peak traffic flow hours or other hours as determined by the AHJ. Travel lanes, parking lanes and sidewalks outside of the construction wall shall be reopened when no construction activities are occurring.

D. When sidewalks or bike paths are closed temporarily, provide alternate detour paths complying with ADA accessibility. In the case of temporarily closed bike lanes or paths, provide signing next to the lane or path and ahead of the work alerting bicyclists to the change. Parking lanes may be used for this purpose if a transition between the existing top of curb and the roadway is accessible. Include proposed design, including pedestrian and bicycle detour and wayfinding signage, and business access signs and devices with the Traffic Control Plan. If the temporary walkway is to remain in place during non-working hours, clearly describe, in a separate section / chapter of the Traffic Control Plan, the traffic control devices to be in place during this period. Obtain applicable permits for parking lane use and sidewalk closures.

E. Do not close sidewalks on opposite sides of the roadway at the same time.

F. Coordinate street closures, lane closures and other in-street work activities, including haul routes, with Fire Departments and other emergency responders. For long-term street closures, notify post offices, major private delivery services, school districts, and solid waste collection operators.

G. Obtain prior approval from local jurisdictions for closing or partial closing of streets, sidewalks or bike routes, as applicable. Give the required advance notice of full and partial street closures after approval of the traffic control plan to agencies providing emergency services, including without limitation, police, fire and ambulance services. Include, at the least, the dates and times of commencement and completion of work, names of streets or location of sidewalks and alleys to be closed or partially closed, and schedule of operations and routes of detours where applicable.

H. Ensure that reliable emergency access is maintained to avoid delays in response times.

I. When the Work involves use of public ways, follow standard construction safety measures, which include but are not limited to, installing advance warning signs and high visibility construction barriers, providing necessary flaggers as required by the local authorities, and installing and maintaining means of reasonable access to fire hydrants, parking garages and other property.

J. Obtain approvals from jurisdictions if detours pass through multiple jurisdictions.

K. Obtain permits required for short-term and long-term, on-street parking displacements.

3.02 TRAFFIC CONTROL MANAGEMENT

A. Before beginning work on the project, designate individual(s) to perform the duties of TCM and TCS, as described in Article 1.04 herein.

B. Identify an alternate TCM and TCS that can assume the duties of the assigned or primary TCM and TCS in case of that person's inability to perform. Alternates will be adequately trained and certified to the same degree as the primary TCM and TCS.

C. Maintain 24-hour telephone numbers at which the TCM and TCS can be contacted and be available at the AHJ's request at other than normal working hours. Supply the TCM and TCS with appropriate personnel, equipment and materials to correct any deficiency in the traffic control system at any time.

D. Patrol the traffic control area daily and reset disturbed signs and traffic control devices.

E. Remove or cover signs and other traffic control devices during periods when they are not necessary.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Administrative and Procedural Requirements for Materials and Equipment related to:

1. Transportation and Handling.

2. Storage and Protection.

3. Product Options.

4. Substitutions.

1.03 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the work. Products may also include existing materials or components required for reuse.

B. Provide interchangeable components of the same manufacturer, for similar components.

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

1.04 TRANSPORTATION AND HANDLING

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

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

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

1.05 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place on sloped supports, above ground.

C. Provide and pay for off-site storage and protection when site does not permit on- site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

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

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

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.06 PRODUCT OPTIONS

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

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

C. Products Specified by naming a Manufacturer “or approved equal”, or with a provision for Substitution Request: Submit a request for substitution for any manufacturer not named.

D. Products Specified by "or approved equal" to a Listed Manufacturer: Products with same function and similar quality and features to listed manufacturer.

E. Products Specified by "Similar To" a Listed Manufacturer: Products with same function and similar quality and features to listed manufacturer.

1.07 SUBSTITUTIONS

A. Architect will consider requests for Substitutions up to 7 calendar days prior to bid opening date.

B. Substitutions may be considered after contract award only when a product becomes unavailable through no fault of the Contractor, or when the Owner deems it to be in the Owner's best interest to do so.

1. Substitutions proposed to allow timely delivery due to Contractor's failure to order material / equipment on time will not be considered.

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

D. A request constitutes a representation that the Bidder / Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the Substitution as for the specified product.

3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension that may subsequently become apparent.

5. Will reimburse Owner for review or redesign services associated with re- approval by authorities.

6. Has investigated and determined that the proposed substitution will meet code requirements.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, if they have not been previously approved.

F. Substitution Submittal Procedure:

1. All substitution requests shall be accompanied with the Substitution Request Form completely filled out. Substitution Request Forms are bound in the Project Manual in Section 01 60 01. Limit each request form to one proposed substitution.

2. Submit one complete set of substitution request forms and supporting data via mail or e-mail.

3. Clearly indicate with red arrows on the supporting data the proposed substitution and accessories.

G. Substitution Review Procedure: Because of the number of substitution requests typically received before bidding and the coordination required to

review these, the following procedures will apply:

1. Substitution requests received after the time specified in paragraph 1.07 A. will not be reviewed or listed in addenda.

2. Substitution requests will be evaluated and the request form will be annotated in the column marked "For Use by Architect." It will then be retained in the A / E's file.

3. The Substitution Request Form and submitted data will not be returned to the submitter. These forms are for the A / E's in-house use only.

4. Only approved substitutions will be listed on addenda. All proposed substitutions not listed on addenda shall be considered by the submitter and the Contractor as a non-acceptable substitution and shall not be used.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 60 01

SUBSTITUTION REQUEST FORM

SUBMITTED TO: Skagit County

PROJECT: Courthouse Rooftop Jail Removal

SPECIFIED ITEM:

Section No.	Paragraph No.	Description of Specified Item

The Undersigned requests consideration for the following substitution to that specified:

PROPOSED SUBSTITUTION:

ATTACHED DATA:

Include product description, specifications, drawings, photographs, performance, and test data as necessary for evaluation. Clearly identify proposed substitution and portions of data from other items where more than one item is described. Include description of changes to Contract Documents required by proposed substitution.

CERTIFICATION:

The Undersigned certifies that the following paragraphs are correct:

1. Proposed substitution does not affect dimensions shown on Drawings.
2. The Undersigned will pay for changes to building design, including engineering design, detailing, and construction costs, caused by requested substitution.
3. Proposed substitution will have no adverse effect on other trades, Construction Schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for proposed substitution.

Undersigned further states that function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

SUBMITTED BY:

Signature _____

Firm _____

Address _____

Date _____

Telephone ( ) _____

FAX ( ) _____

FOR USE BY ARCHITECT:

☐ Approved ☐ Approved as Noted

☐ Not Approved ☐ Received too Late

By _____

Date _____

Remarks _____

END OF SECTION

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. General Procedural Requirements Governing Execution of the Work including, but not limited to, the following:

1. Construction Layout.
2. Field Engineering and Surveying.
3. General Installation of Products.
4. Progress Cleaning.
5. Starting and Adjusting.
6. Protection of Installed Construction.
7. Correction of the Work.

1.03 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the type required for this project.

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 EXAMINATION

A. Existing Conditions / Utilities: The existence and location of site

improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of existing utilities and other construction affecting the Work.

1. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions: Start of work / installation indicates acceptance of existing conditions as not conflicting with the requirements of the Contract Documents or the design intent and being acceptable without any modification.

3.02 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a Request for Information (RFI) to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 CONSTRUCTION LAYOUT

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

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels as needed to locate each element of Project.

2. Establish horizontal layout as shown on the Control Plans included in the Drawings. Do not scale Drawings to obtain required dimensions.

    a. Architect / Engineer will provide a digital drawing file of the Control Plans to the surveyor upon request, subject to surveyor's agreement to Architect / Engineer's standard release agreement.

    b. Surveyor is responsible for verifying the data shown on the digital Drawing file prior to start of any construction operation as follows:

        1) Check the survey points shown from more than one control point.

        2) Verify the accuracy of the layout shown against the existing site conditions.

        3) Verify that the relationships shown on Drawings between utilities, buildings and site improvements matches the actual survey relationships.

    c. Notify Architect of any discrepancies in the survey points shown on the digital Drawing file immediately and assist in resolving the discrepancy prior to installing the construction staking or start of any construction operation.

3. Inform installers of lines and levels to which they must comply.

4. Notify Architect when deviations from required lines and levels exceed the following tolerances:

    a. Horizontal Layout: 1-inch in 400 feet

    b. Vertical Layout: 0-inches

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

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including

those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect / Engineer.

3.04 FIELD ENGINEERING

A. 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 / Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect / Engineer before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

3.05 INSTALLATION

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

1. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

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

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

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

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

C. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

D. 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.

E. 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.

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

3.07 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: Arrange for a factory-authorized service representative to inspect and repair any piece of equipment that does not function properly or cannot be made to operate as specified.

3.08 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.

3.09 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction.

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

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

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

END OF SECTION

SECTION 01 78 00

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Administrative and Procedural Requirements for the Contract Closeout including:

1. Closeout Procedures and Documents.
2. Final Cleaning.
3. Adjusting.
4. Extra Stock.
5. Spare Parts and Maintenance Materials.
6. AHJ Approved Permit Drawing Set.
7. As-Built Documents.
8. Operation and Maintenance Data and Bonds and Warranties.
9. Punch List.
10. Final Adjustment of Accounts.

1.03 CLOSEOUT PROCEDURES AND DOCUMENTS

A. Comply with the General Conditions of the Contract.

B. Submit draft As-Built Documents and draft Operations and Maintenance Data and Warranty documents prior to Substantial Completion.

C. Submit final closeout documents as required for Project closeout.

1.04 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion review and during the period between Substantial and Final Completion where punch list work causes

waste, rubbish or debris.

B. Clean surfaces exposed to view, remove temporary labels, stains and foreign substances. Follow manufacturer's recommendations for cleaning installed products.

C. Clean equipment and fixtures to sanitary condition.

D. Clean dirt and debris from drainage systems.

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

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

1.05 ADJUSTING

A. Adjust operating products and equipment in accordance with manufacturer's recommendations and specification section to ensure smooth and unhindered operation.

1.06 EXTRA STOCK

A. Provide extra stock in quantities specified in individual specification sections.

B. Make arrangements with the Owner’s representative to deliver extra stock items, prior to final payment.

C. Document receipt of extra stock by Owner's representative by listing each extra stock item and obtaining the signature of the Owner's representative for it. Include this document in Part 1 of the O and M Manual.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.

B. Make arrangements with the Owner’s representative to deliver products, spare parts, maintenance and extra materials, prior to final payment.

C. Document receipt of products, spare parts, maintenance and extra materials by Owner's representative by listing each product, spare part, maintenance and extra material item and obtaining the signature of the Owner's representative for it. Include this document in Part 1 of the O and M Manual.

1.08 AHJ APPROVED PERMIT DRAWING SET

A. During construction, maintain Permit Set of drawings in good, clean condition and protect from damage or marks.

B. After obtaining the Certificate of Occupancy, make arrangements with the Owner's representative to deliver AHJ approved Permit Set of drawings to the Owner for their permanent record, prior to final payment.

C. Document receipt of Permit Set of drawings by Owner's representative by obtaining the signature of the Owner's representative for it. Include this document in Part 1 of the O and M Manual.

1.09 AS-BUILT DOCUMENTS

A. As-Built Documents shall consist of the following:

1. Contract Documents:

a. Contract Drawings with As-Built Revisions noted.

b. Reviewed Shop Drawings, Product Data and Samples.

2. Drawings of Contractor designed systems, (i.e. joists, trusses, fire sprinkler system, fire alarm system, controls system, etc.).

B. During Construction:

1. Maintain on-site throughout the construction period, one set of As-Built Documents and record actual revisions to the work on these documents. As-Built Documents and records specified below may be kept in electronic format with on-site access and with off-site weekly backup.

a. Store As-Built Documents separate from documents used for construction.

b. Record information concurrent with construction progress.

c. Contract Drawings: Legibly mark, cloud and flag each item to record actual construction including:

1) Surveyed as-built conditions.

2) Measured horizontal and vertical locations of underground utilities referenced to permanent surface improvements.

3) Measured location of internal utilities concealed in construction, referenced to visible and accessible features of the work.

4) Field changes of dimensions and detail.

5) Details not on original Contract Drawings.

C. Prior to Contract Closeout: Prepare and submit As-Built Documents to the Architect as follows:

1. As-Built Document Content:

a. As-Built Utility Survey: Provide survey of site utility piping and structures with location and elevation, performed by a professional surveyor. Survey information shall be recorded on the Contract Drawings for inclusion in the As-Built Drawings.

b. As-Built Project Drawings: Drawings shall be in good, clean condition and legibly marked in red ink (red text) to show revisions and changes made during construction and as-built conditions. Mark or stamp bottom of each sheet “As-Built Drawings, Name of Construction Company, Date”.

c. Contractor Designed Systems: Electronically update the contractor designed system drawings with as-built conditions. Mark or stamp bottom of each sheet “As-Built Drawings, Name of Construction Company, Date”.

2. Draft Submittal:

a. Submittals shall be submitted in the following packages:

1) Architectural.

2) Structural.

3) Plumbing.

4) HVAC.

5) Electrical.

b. Digital Copy: Submit a digital draft copy in with the content described below in PDF format for review by Architect / Engineer and Owner. The digital copy will be returned to Contractor with Architect / Engineer and Owner comments. Revise content of documents as required by Architect / Engineer and Owner comments prior to submitting final documents. Organize the submittal as follows:

1) As-Built Survey: Provide one PDF file and label the file “As- Built Utility Survey”.

2) As-Built Project Drawings: Provide a separate PDF file for each discipline and label the file “As-Built_*Discipline*”. Each file shall have each page bookmarked and labeled to match the sheet numbers.

3) Contractor Designed Systems: Provide one PDF file for each set of system Drawings and label each file per its content.

3. Final Submittal:

a. Printed Copy (Hard Copy): Submit two (2) sets of revised documents. Organize the submittal as follows:

1) As-Built Survey: Provide printed copy on 20 lbs. white paper.

2) As-Built Project Drawings: Provide printed copy on 20 lbs. white paper in color so red ink (red text) is in color.

3) Contractor Designed Systems: Provide printed copy of each set on 20 lbs. white paper.

b. Digital Copy: Submit a digital copy of the revised documents in PDF format. Digital copy shall be in color so red ink (red text) is in color and matches the format of the draft submittal.

1.10 OPERATION AND MAINTENANCE DATA AND BONDS AND WARRANTIES

A. Operation and Maintenance Data: Refer to Section 01 78 23.

B. Bonds and Warranties: Refer to Section 01 78 33.

1.11 PUNCH LIST

A. Contractor Punch List: Upon completion of the Work, the Contractor shall walk- through each room / area in the building and around the entire exterior and site and prepare a punch list of each item of work that is not completed or does not conform to the requirements of the Contract Documents.

B. Architect's Punch List: After completion of the punch list by the Contractor, provide written notice that the Work has been substantially completed and schedule a room by room punch list walk-though with the Architect and Owner to review the finished work and Contractor's punch list items.

1. On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements.
2. Any additional items of uncompleted or unacceptable work that are found during this walk-through shall be added onto the Punch List for completion / correction.

3. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

C. The project budget provides for two final visits to the project site by the Architect / Engineer for performing a punch list review of the work. The first visit will be in response to the Contractor's notice of substantial completion of the Work and if necessary, the second will be after notification by the Contractor that punch list items and deficiencies noted during punch list review have been corrected.

D. Should additional reviews by the Architect / Engineer be required due to the Contractor's failure to correct deficient work, the Owner will deduct the amount of Architect / Engineer compensation for re-review services from final payment to Contractor.

1.12 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Architect.

B. Reflect all adjustments to Contract Sum. Indicate following:

1. The Original Contract Sum;

2. Additions and deductions resulting from:

   a. Previous change orders;

   b. Alternates;

   c. Unit price adjustments;

   d. Deductions for uncorrected work;

   e. Deductions for liquidated damages;

   f. Deductions for additional review services;

   g. Other adjustments;

3. Total Contract Sum, as adjusted;

4. Previous Payments; and

5. Sums remaining due.

C. Prior to processing of Final Application and Certificate for Payment, all Closeout Documents including Project Record Documents, Operations and Maintenance Manuals and Warranty Binders must be submitted, reviewed and accepted by the Architect.

PART 2 - PRODUCTS

2.01 BINDERS

A. Binders: Binders shall be black and have heavy-duty durable vinyl covers on front, back and spine, and have heavy duty metal D-rings.

B. Dividers: Similar to Avery *Print-On Dividers, 8 Tab*.

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Operation and Maintenance Data.

1.03 SCOPE OF WORK

A. To aid the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding the products incorporated into the Work, furnish and deliver the data described in this Section and in pertinent other Sections.

B. Related Work:

1. Required contents of submittals also may be amplified in pertinent other Sections.

1.04 SUBMITTALS

A. Comply with applicable provisions of Section 01 33 00.

B. Submit one electronic (PDF) copy of a preliminary draft of the proposed Manual or Manuals to the Architect for review and comments.

C. Unless otherwise directed in other Sections, or in writing by the Architect, submit two printed copies of the final Manuals and one electronic (PDF) copy to the Architect prior to instruction of operation and maintenance personnel.

1.05 QUALITY ASSURANCE

A. In preparing data required by this Section, use only personnel who are thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in technical writing to the extent needed for communicating the essential data.

PART 2 - PRODUCTS

2.01 INSTRUCTIONS

A. Where instruction Manuals are required to be submitted under other Sections of these Specifications, prepare in accordance with the provisions of this Section.

B. Format:

1. Size: 8-1/2-inch x 11-inch.

2. Paper: White bond, at least 20 lb wt.

3. Text: Neatly written or printed.

4. Drawings: 11-inch height (11x17) preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.

5. Flysheets: Separate each portion of the Manual, by Specification Section, with neatly prepared flysheets briefly describing contents of the ensuing portion; flysheets may be in color.

6. Measurements: Provide all measurements in U. S. standard units such as feet-and-inches, lbs, and cfm.

7. Manuals shall be clearly identified on the cover with at least the following information:

2.02 OPERATING AND MAINTENANCE INSTRUCTIONS

( )
(name and address of work)
_____

( )
(name of contractor)
_____

( )
(general subject of this Manual)
_____

( )
(space for approval signature of)
_____

( )
(the Architect and approval date)
_____

A. Contents: Include at least the following:

1. Neatly typewritten index near the front of the Manual, giving immediate information as to location within the Manual of all emergency information regarding the installation.

2. Complete instructions regarding operation and maintenance of all equipment involved including lubrication, disassembly, and re-assembly.

3. Complete nomenclature of all parts of all equipment.

4. Copy of all guarantees and warranties issued.

5. Manufacturers' bulletins, cuts, and descriptive data, where pertinent, clearly indication the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.

6. Such other data as required in pertinent Sections of these Specifications.

PART 3 - EXECUTION

3.01 INSTRUCTION MANUALS

A. Preliminary:

1. Prepare a preliminary draft of each proposed Manual.

2. Show general arrangement, nature of contents in each portion, probable number of drawings and their size, and proposed method of binding and covering.

3. Secure the Architect's approval prior to proceeding.

B. Final: Complete the Manuals in strict accordance with the approved preliminary drafts and the Architect's review comments.

C. Revisions:

1. Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of the Manual with the Architect.

2. If the Contractor is required by the Architect to revise previously approved Manuals, compensation will be made as provided for under "Changes" in the General Conditions.

END OF SECTION

SECTION 01 78 33

BONDS AND WARRANTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Bonds and Warranties.

1.03 SCOPE OF WORK

A. Compile specified certificates, bonds, and similar certification.

B. Compile specified services and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

1. Submit to Architect on Contractor's letterhead. Architect reviews and transmits to Owner.

E. Related Requirements:

1. Coordinate related requirements specified in other parts of the Project Manual, including but not limited to following.

a. Operating and Maintenance Data with Section 01 78 23.

b. Each respective Section as required.

1.04 SUBMITTALS

A. Assemble executed certificates, warranties, bonds, and any required service and maintenance contracts from the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: One printed copy of each and one electronic copy (PDF) of each.

C. Contents: Neatly type Table of Contents in orderly sequence. Furnish complete information for each item as follows:

1. Product or work item;

2. Firm, with name of principal, address, and telephone number;

3. Scope;

4. Date of beginning of warranty or service and maintenance contract;

5. Duration of warranty or service maintenance contract;

6. Information for Owner's personnel, including:

   a. Proper procedure in case of failure;

7. Instances which might affect validity of warranty or bond.

8. Contractor, name of responsible principal, address, and telephone number.

1.05 FORM OF SUBMITTALS

A. Prepare in duplicate, packets conforming to following requirements.

1. Size: 8-1/2-inch X 11-inch punched sheets for 3-ring binder. Fold larger sheets to fit into binders.

2. Binders: Commercial quality heavy-duty plastic or fiberboard 3-ring D-ring binders. All binding is subject to the Architect's approval.

3. Covers: Identify each packet with typed or printed title "WARRANTIES AND BONDS" and showing:

   a. Title of Project.

   b. Name of Contractor.

B. Format / Warranties / Guarantees:

1. In addition to guarantees required by "General Conditions of Contract", furnish written guarantees warranting certain portions of work for longer periods.

2. Address them to Owner.

3. Submit through Architect on Contractor's letterhead before final payment and acceptance of work by Owner.

4. Where more than one subcontractor is involved, submit guarantee for

each.

C. Form of Guarantee for other specified installation:

1. I (We), (insert name of contractor), certify (insert name of trade or portion of work being guaranteed) installed by (insert name of appropriate subcontractor) on (insert name of job) located at (insert building/site name and address) is performed in strict accordance with Contract Documents. Further, I (We) guarantee this work to be (watertight, and without leaks) (other) caused by defects in materials and workmanship, for (fill in specific required guarantee period) years from (date of acceptance of work), and will repair, or replace, without delay, any defects in materials and workmanship discovered within guarantee period.

   Sincerely,

   (Name of Contractor / responsible principal / address/telephone number). Signed by Owner, Partner, or other person authorized to commit firm.)

1.06 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction:

1. Submit documents within ten days after final inspection and acceptance; or:

   a. Otherwise make submittals within ten days after Date of Substantial Completion, prior to final request for payment.

B. For items of work, where acceptance is delayed materially beyond the date of Substantial Completion, provide updated submittal within ten days after acceptance. List the date of acceptance as the start of the warranty period.

1.07 WARRANTY LENGTHS AND START DATES

A. All materials, parts, and labor shall be warranted for a minimum period of (1) one year; unless greater lengths for specific sections are specified elsewhere within the Project Manual.

B. Warranty periods shall begin on the date established as Substantial Completion.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 00 and 01 Specification Sections, apply to work of this section.

1.02 SECTION INCLUDES

A. Demonstration and Training.

1.03 SUMMARY

A. Work requiring instruction of Owner's personnel is specified in individual Sections.

B. Related Sections:

1. Operation and Maintenance Data: Section 01 78 23.

1.04 COMMISSIONING

A. Schedule instructional meeting or meetings within 2 weeks after Operation and Maintenance manuals have been accepted by the Architect.

B. Prior to final inspection, fully qualified manufacturers' representatives shall fully instruct Owner's designated operating and maintenance personnel in operation, adjustment, and maintenance of equipment and systems.

C. Basis of Instruction: Operation and maintenance manuals. Review contents of manuals with Owner's designated personnel, in full detail, to explain all aspects of operation and maintenance.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. All works necessary for the selective demolition of the 4th floor of the project building.
2. Protection of portion of the building adjacent to, immediately below or affected by selective demolition.
3. Removal and legal disposal of debris.
4. Salvage of designated items.
5. Requirements for engineered demolition plan.

B. Basic Procedures and Schedules: Demolition should be done cautiously to avoid endangering nearby structures and finishes that will remain. Coordinate demolition activities to avoid conflicting with court proceedings. Do not obstruct entrances or exits to existing facilities. Control the dust and create safety precautions.

C. Hazardous materials: Refer to Appendix E for available Asbestos and Lead Testing Reports

1.02 REFERENCES

A. American National Standards Institute

1. ANSI A10.6 - American National Standard Safety Requirements for Demolition.

B. Debris Stockpiling map generated by Peterson Structural Engineers (Structural).

C. Demolition layout generated by Allana Buick & Bers (Arch)

D. Demolition Work Plan generated by Contractor.

E. Demolition requirements and permitting according to local building authority.

1.03 SUBMITTALS

A. Existing Building Documentation: Submit the following for existing structures indicated to remain.

1. Survey indicating position and elevation of exterior building features.
2. Photographic survey indicating conditions before, during, and after demolition work.

B. Demolition Work Plan: The Contractor shall provide a Construction Work Plan that includes all of the elements included in these Specifications, as well as a comprehensive overview of the Contractor's planned means and techniques, schedules and sequences of work. The document should be reviewed and approved by Professional Engineer licensed in Washington State.

C. Temporary Out of Plane Bracing Plan: The contractor shall provide temporary out of plane bracing plan to support the freestanding concrete wall to remain at the mechanical room during demolition and construction of new cold form steel wall and roof.

D. Permits: Contractor shall secure and maintain the demolition permits in accordance with the local building officials.

E. Health and Safety Plan: A site-specific health and safety plan (HASP) must be created by the contractor and made available on site.

F. Schedule: The Contractor is required to create and submit a thorough demolition schedule that includes the start and end dates for each phase of the operation. The timeline must follow all guidelines outlined in the contract terms. Work must be done in a way that doesn't interrupt nearby daily court activity.

1.04 QUALITY ASSURANCE

A. Codes and Regulations: Perform Work in accordance with rules and regulations of state and local agencies having jurisdiction for demolition of structures, safety of adjacent structures, dust control, runoff control, and disposal of debris.

B. Limits: Take care to break concrete in reasonably manageable volume.

1. Cutting of concrete and asphalt shall be made clean and neat. Exposed cut ends of reinforcing steel shall be coated with a corrosion inhibitor.

2. At limits of demolition Work shown or specified, provide neat, orderly, and clean joints, lines, and edges of surfaces, whether for junctions with new materials or surfaces or whether to be left as existing. Where demolitions methods or controls may not permit the intended jointure, submit conditions and alternatives to EOR, and obtain resolutions prior to commencing.

3. Do not cut or alter structural members unless indicated to do so on the Drawings or written approval is received from EOR.

4. Take care not to damage reinforcing or structural steel and concrete wall scheduled to remain in place.

C. Temporary Shoring: Temporary shoring supporting the remaining freestanding concrete wall shall not be removed before the complete construction of new CFS wall and roof structure. Shoring may also be required at elevator overhang until brackets are in place to support the wall.

D. Reuse: Some items removed may be scheduled for re-installation. Prior to removal, provide an identification system to insure items are reinstalled in original location. Contractor is responsible for providing a secure and weather protected location to store items to be reinstalled.

E. Only qualified Demolition Contractors shall be employed for the Work.

F. Structural Elements: Do not remove structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

G. Operational Elements: Do not remove operating elements and related components in a manner that results in reducing their capacity to perform as intended or results in increased maintenance or decreased operational life or safety.

H. Miscellaneous Elements: Do not remove miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or results in increased maintenance or decreased operational life or safety.

I. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's

aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

J. Dust Control: Take appropriate action to check the spread of dust to occupied portions of the building and to avoid the creation of a nuisance, in the surrounding area. Do not use water if it results in hazardous or objectionable conditions. Comply with all dust regulations imposed by local air pollution agencies.

K. Odors: Provide warnings to occupants 48 hours before application of potentially odorous materials. Ensure all applications are performed in compliance with all applicable regulations for health safety.

L. Hazardous Materials: Hazardous materials are identified in appendix. All elements noted in Lead and Asbestos surveys shall be safely removed and disposed of by the Contractor. Any other potentially hazardous material removal shall be identified and tested prior to removal. Cost for additional testing and removal shall be provided prior to engaging in work.

M. Salvage Items: Some items may be salvaged by Owner. Such items will be tagged prior to removal. Contractor shall remove and store items on site, when requested by Ownership.

N. Buildings: Protect existing work that is to remain in place, or that is to be reused. Repair items damaged during performance of the work or replace with new. Do not overload structural elements. Provide new supports or reinforcement for existing construction weakened by demolition or removal work.

1.05 SEQUENCING

A. Immediate areas of work shall not be accessible to public during selective demolition work.

1.06 WARRANTY

A. Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials to not void warranties, and to the acceptance of the Owner.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Corrosion Inhibitor: Sika FerroGard – 903 or engineer approved equal

PART 3 - EXECUTION

3.01 SELECTIVE DEMOLITION

A. Existing building documentation

1. Before performance of work, make inspection and report defects and structural weaknesses of structures to be partially demolished, cut, or removed, of adjacent structures, and of improvements remaining.

2. After performance of work, make inspection and document conditions including defects and structural weaknesses of:

a. Adjacent structures indicated to remain.

b. Structures partially demolished, cut, or removed.

c. Improvements indicated to remain.

B. Demolition Operations: Perform work in accordance with ANSI A10.6 unless otherwise noted. Do not damage building elements indicated to remain. Prior to re-use, all debris should be removed from items marked for re-use. Absolute care should be taken not to punch hole into the existing slab during any point of demolition.

C. Utilities: Locate, identify, disconnect, and seal or cap off utilities in portions to be demolished.

D. Shoring and Bracing: Provide out of plane braces to support remining concrete freestanding wall and elevator room overhang. Out of plane shall not be removed prior to the complete construction of the new CFS wall and roof structure.

E. Closed Areas: Close areas below demolition work to anyone while removal is in progress.

F. General Safety: Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required. Maintain these items during the demolition period.

G. Protection: Provide adequate scaffolding, shoring, bracing railings, toe boards and protective covering during demolition to protect personnel and equipment against injury or damage. Cover floor openings not used for material drops with material substantial enough to support any loads placed on it. Properly secure the covers to prevent accidental movement. Carefully protect all mechanical and electrical equipment against dust and debris.

H. Removal: Remove all debris from the structures during demolition and do not allow debris to accumulate in piles. For temporary stockpiling, only the areas and weight designated on the stockpile map created by the structural engineers shall be used.

I. Access: always Provide safe access to and egress from all working areas with adequate protection from falling material.

J. Occupied Spaces: Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

K. Material Drops: Do not drop any material to any point lying outside the exterior walls of the structure unless the area is effectively protected.

L. Operations: Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

M. Additional care should be taken when working above the main courtroom. Note reduced allowable stockpile load intended to help prevent cracking of interior finishes.

N. Restoration and Repair: Promptly repair damage to adjacent construction caused by demolition operations.

1. Where repairs to existing surfaces are required, patch to restore surface to original or better condition.

2. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.02 DISPOSAL OF MATERIALS

A. Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site.

B. Remove materials as work progresses. Upon completion of Work, leave areas in clean condition.

END OF SECTION

SECTION 03 21 00
REINFORCING STEEL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all the work necessary to furnish all labor, materials, equipment, and services necessary to furnish reinforcing steel, accessories, welding, equipment and services, and place concrete reinforcement.

B. Section includes:

1. Reinforcing steel.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete Work.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings of detailed placing and bending lists for the ENGINEER's approval before the reinforcement is fabricated.

B. Submit information on any reinforcing to be field bent as covered in Section 3.1.B.

C. Mill Certificates: Mill test certificates shall be submitted to the ENGINEER to certify that the reinforcing steel meets the specified requirements. Mill test certificates shall be furnished and paid for by the CONTRACTOR.

D. In addition, the ENGINEER may require that test samples be taken, and test certificates be furnished by a reputable material testing laboratory at the OWNER's expense.

1.4 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 117 “Specifications for Tolerances for Concrete Construction and Materials and Commentary”

B. American Welding Society (AWS)

1. AWS D1.4 “Structural Welding Code – Reinforcing Steel”

C. ASTM International (ASTM)

1. ASTM A184 “Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement”

2. ASTM A615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement"

3. ASTM A706 "Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement"

4. ASTM A767 "Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement"

5. ASTM A775 "Standard Specification for Epoxy-Coated Steel Reinforcing Bars"

6. ASTM A884 "Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement"

7. ASTM A934 "Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars"

8. ASTM A955 "Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement"

9. ASTM A970 "Standard Specification for Headed Steel Bars for Concrete Reinforcement"

10. ASTM A1022 "Standard Specification for Deformed and Plain Stainless-Steel Wire and Welded Wire for Concrete Reinforcement"

11. ASTM A1044 "Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete"

12. ASTM A1055 "Standard Specification for Zinc and Epoxy Dual Coated Steel Reinforcing Bars"

13. ASTM A1060 "Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete"

14. ASTM A1064 "Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete"

D. Concrete Reinforcing Steel Institute (CRSI)

1. CRSI 10MSP "(2018) Manual of Standard Practice"

2. CRSI RB4.1 "(2016) Supports for Reinforcement Used in Concrete"

1.5 QUALITY CONTROL

A. The ENGINEER may require that test samples be taken, and test certificates be furnished by a reputable material testing laboratory at the OWNER's expense.

PART 2 PRODUCTS

2.1 DEFORMED REINFORCING BARS

A. Unless otherwise specified, reinforcing steel shall be Grade 60 billet steel conforming to ASTM Specification A615 or ASTM 706.

1. All such reinforcing shall be deformed steel bars with *deformations* conforming to the requirements set forth in ASTM Specification A615 or ASTM 706

2. Stirrups and Ties shall be Grade 60.

B. Spiral reinforcement and steel wire shall be cold-drawn steel wire conforming to the requirements of ASTM Specification A1064 unless shown otherwise on the Drawings.

C. Welded Wire Fabric (WWF) shall conform to ASTM Specification A1064.

D. Bar and rod mats for concrete reinforcement conforming to ASTM A184

E. Tie wire, 16 gauge or heavier black annealed wire.

F. Varying grades shall not be used interchangeably in structures.

G. Reinforcing bars shall conform to the requirements of ACI 318 with lengths and bends in accordance with the fabrication tolerances of ACI 117.

1. Reinforcing bars shall be shop fabricated unless approval is provided by the ENGINEER for field bends. See Section 3.1.B for additional information on field bending.

2. Bending shall be done cold and accomplished so that the steel will not be damaged.

3. Kinked bars shall not be used.

2.2 PLAIN REINFORCING BARS

Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A1064 unless shown otherwise on the Drawings.

Plain smooth dowels and ¼-inch diameter smooth bars conforming to ASTM A615 Grade 60.

2.3 SUPPORTS

A. Bar supports shall conform to ACI 315 and CRSI Manual of Standard Practice, Chapter 3, Bar Supports

B. Bar supports shall consist of approved high density "adobes", stainless steel chairs, plastic spacers, or plastic shim plates.

1. Brick, broken concrete masonry units, spalls, rocks or similar materials **shall not** be used for support of reinforcing steel.

2. Steel chairs shall be furnished with plastic tips when incorporated into concrete exposed to view, such as in the roof slab.

3. Plastic spacers shall be PRECO BARSPAN WHEELS, as manufactured by the PRECO CORPORATION or equal.

4. Plastic shim plates may be used to support the plastic spacers and shall be used to support the vertical reinforcing in the corewall, unless shown otherwise on the Drawings.

C. Hot-dipped Galvanized Reinforcing Bars

When reinforcing bars are indicated on the Drawings to be hot-dipped galvanized, they shall be galvanized in accordance with ASTM A767 and ASTM A143. The grade of reinforcing bars shall be as specified under Section 2.1. The bars shall be galvanized in conformance with a Class 1 coating and shall be galvanized after fabrication and shearing.

D. Steel Tie Wire: Annealed steel tie wire shall be used to fasten the reinforcing steel in place.

PART 3 EXECUTION

3.1 REINFORCING BARS

Comply with the specified codes and standards and Concrete Reinforcing Steel Institutes recommended practice for "placing reinforcing bars," for details and methods of reinforcement placement and supports, and as herein specified.

A. General

1. Mild steel reinforcing bars shall be furnished, cut, bent and placed as indicated on the Drawings.

2. At the time of placing concrete, all reinforcement shall be free from loose mill scale, rust, grease, oil, or other coating which might destroy or reduce its bond with concrete.

   a. Reinforcing bars with rust, mill scale or a combination of both will not be acceptable without cleaning or brushing provided that upon wire brushing a sample, the dimensions including height of deformations and weights shall not be less than the applicable ASTM requirements. Steel reinforcement which is to be placed in the work shall be stored under cover to prevent rusting and shall be placed on blocking such that no steel touches any ground surface.

3. All reinforcing steel placed in the work shall be tied together and supported in such a manner that displacement during placing of concrete and shotcrete will not occur.

4. When there is a delay in depositing concrete, reinforcement shall be re-inspected and cleaned when necessary.

B. Fabrication (Cutting and Bending)

1. Steel reinforcement shall be cut and bent in accordance with ACI 318 and to the tolerances of ACI 117 with approved practices and machine methods.

    a. Bar bending shall be performed in the shop and all bars shall be bent cold.

    b. If field bending is required, submit locations requiring field bending to the ENGINEER for review and approval.

    c. Rebending of reinforcing bars that have been bent incorrectly is not permitted.

    d. Bending, rebending, or straightening of reinforcing bars that have been cast into concrete is not permitted.

2. Reinforcement shall be accurately formed to the dimensions indicated on the Drawings and on the bending schedule.

3. Bends for hooks on bars shall be made around a pin having a diameter not less than six times the minimum thickness of the bar.

4. Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

5. Do not use reinforcing that has any of the following defects:

    a. Bar lengths, depths, and bends beyond the specified fabrication tolerances.

    b. Bends or kinks not indicated on the drawings or approved shop drawings.

    c. Bars with reducing cross-section due to rusting or other causes.

6. Replace defective reinforcement with new reinforcement having the required shape, form, and cross-section area.

C. Minimum Bar Spacing

The clear distance between parallel bars shall not be less than one and one-half times the diameter of the bars and, unless specifically authorized, shall in no case be less than 1-inch, nor less than the maximum size of coarse aggregate specified.

D. Concrete Cover (Minimum)

1. On all formed surfaces which will be exposed to water, ground or the elements, there shall be a nominal cover over the steel of 2.0-inches for bars number 6 through number 18 and 1-1/2 inches for bars number 5 and smaller, with an installation tolerance of + 1/4 inch. When crossing bars of different diameter are encountered in one face, one shall consider

the bar size and location that will provide the largest cover over the nearest steel to the outside surface.

2. Unless otherwise specified in these specifications or shown on the Drawings, all reinforcing steel facing subgrades for concrete construction of the foundation or below-grade elements shall be given a nominal protective cover of 3.0-inch minimum. The largest cover shall be used when different size bars are encountered in one face.

3. The minimum cover over reinforcing steel for concrete construction of other facilities shall be as shown on the Drawings.

4. No "bury" or "carrier" bars will be allowed unless specifically approved by the ENGINEER.

E. Splicing

1. Except as shown or specified on the Drawings, reinforcing steel shall not be spliced at any location without specific approval by the ENGINEER. Splices in adjacent bars shall be staggered.

2. Where permitted or required, splices in reinforcing steel shall have sufficient lap to transfer full strength of the bar by bond and shear. Unless specified or shown otherwise on the Drawings, the bars at a lap splice shall be in contact with each other. In no event shall the lap be less than 40 diameters of the spliced bars.

3. Unless specified or shown otherwise on the Drawings, bars shall be lap spliced in accordance with ACI 318 and shall be fastened together with steel tie wire.

4. Unless shown otherwise on the Drawings, where bars are to be lapped spliced at joints in the concrete, all bars shall project from the concrete first placed, a minimum length equal to the lap splice length indicated on the Drawings. All concrete or other deleterious coating shall be removed from dowels and other projecting bars by wire brushing or sandblasting before the bars are embedded in a subsequent concrete placement.

F. Supports

1. All reinforcement shall be retained in place, true to indicated lines and grades, by the use of approved bar supports. The CONTRACTOR shall submit for ENGINEER's approval, samples of all bar supports he proposes to use along with a written description of where each bar support will be used.

2. The supports shall be of sufficient quantity, strength, and stability to maintain the reinforcement in place throughout the concreting operations. Bar supports shall be placed no further than 4 feet apart in each direction. Supports must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete. The CONTRACTOR shall be held responsible for providing the appropriate quantity and type of bar supports.

3. Do not place reinforcing bars more than two inches beyond the last leg on continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

G. Bar Tying

1. Bars shall be tied sufficiently often to prevent shifting. There shall be at least three ties in each bar length (this shall not apply to dowel laps or to bars shorter than 4 feet, unless necessary for rigidity).

2. Slab bars shall be tied at every intersection around the periphery of the slab. Wall bars and slab bar intersections shall be tied at not less than every fourth intersection, but at not greater than the following maximum spacings:

	Slab Bars (in)	Wall Bars (in)
Bars No. 5 and smaller	60	48
Bars No. 6 through No. 9	96	60
Bars No. 10 through No. 11	120	96

H. Reinforcement Around Openings -- Where reinforcing steel has to be cut to permit passage of pipe or to create openings, and should no detail be shown for extra reinforcing in such areas, the area of steel removed by the creation of the opening must be replaced by placing at least double the area of steel removed by the opening equally around the openings. The steel shall be placed such that it extends 5 feet beyond the opening on each side to provide for sufficient bond.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE WORK

PART 1 GENERAL

1.1 SUMMARY

A. The extent of concrete work is shown on the Drawings.

B. Work includes providing formwork and shoring for cast-in-place concrete, and installation of related items including reinforcing steel bar (rebar), anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

C. Definitions

1. Batch: Used in this specification to define an overall class of concrete as delivered from a concrete batching plant or on-site batching operation. Batching operations can continue for hours or days and as long as the class of concrete is similar, the batch would be considered the same. Multiple mixer truck loads could be used to deliver a “batch” of concrete over the course of multiple hours or days.

2. Batched/Batching: The loading of concrete, as combined and mixed at a batching/ready-mix plant, into a concrete mixer truck for delivery to the job site.

3. Truckload: A standard concrete mixer truck size is assumed to have a concrete capacity of 8 cubic yards. A truckload is used to help define the frequency of testing which of occurs per concrete mixer truck.

4. Ready-Mix Concrete: Concrete that is manufactured in a batch plant, according to a set engineered mix design. This specification assumes ready-mix concrete will be delivered by mixer truck to the job site.

1.2 RELATED SECTIONS:

A. Section 03 21 00 - Reinforcing Steel.

1.3 SUBMITTALS

A. For information only, submit an electronic copy of manufacturer’s data with application and installation instructions for proprietary materials and items, including reinforcement, and forming accessories, admixtures, patching compounds, water stops, joint systems, chemical floor hardeners, dry-shake finish materials, and others. Bind and submit in one submittal.

B. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with the ACE 315 “Guide to Presenting Reinforcing Steel Design Details” showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures and indicate proposed spacer or carry bars.

C. Submit shop drawings for fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of forms including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items which affect the

exposed concrete visually. Submit form drawings for building columns, walls, fascia, and intersections, and concrete pan and joist system. Submit for typical sections only. ENGINEER's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the CONTRACTOR's responsibility.

D. Submit electronic copy of laboratory test reports for concrete materials, and mix design tests as specified.

E. Material Certificates may be provided in lieu of materials laboratory test reports. The material manufacturer and the CONTRACTOR, certifying that each material item complies with, or exceeds, the specified requirements shall sign material certificates.

F. Concrete Thermal Control Plan: Submit information on temperature monitoring system or process to be used to verify the internal and differential temperature of mass concrete. Additionally, the plan shall outline proposed methods to keep temperatures within acceptable ranges. The plan shall include:

1. Temperature monitors and equipment
2. Insulation
3. Concrete cooling before placement
4. Concrete cooling after placement (i.e. cooling pipes)
5. Method of Placement (i.e. smaller or less frequent placements)
6. Other methods as proposed by the CONTRACTOR and approved by the ENGINEER

1.4 REFERENCES

Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified here:

A. American Concrete Institute (ACI)

ACI 301 "Specifications for Concrete Construction"

ACI 311 "Guide for Concrete Inspection"

ACI 318 "Building Code Requirements for Structural Concrete"

ACI 347 "Guide to Formwork for Concrete"

ACI 304 "Guide for Measuring, Mixing, Transporting and Placing Concrete"

ACI 308R "Guide to External Curing of Concrete"

B. American Society for Testing and Materials (ASTM)

1. A1064, "Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete "

2. C31, “Making and Curing Concrete Test Specimens in the Field “
3. C33, “Specification for Concrete Aggregate “
4. C39, “Compressive Strength of Cylindrical Concrete Specimens“
5. C40, “Organic Impurities in Fine Aggregate for Concrete “
6. C85, “Cement Content of Hardened Portland Cement Concrete “
7. C88, “Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate “
8. C94, “Standard Specifications for Ready-Mixed Concrete“
9. C131, “Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine“
10. C136, “Method for Sieve Analysis to Fine and Coarse Aggregate“
11. C138, “Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete -- eLearning Course“
12. C143, “Slump of Portland Cement Concrete“
13. C150, “Standard Specification for Portland Cement“
14. C156, “Water Retention by Concrete Curing Materials“
15. C173, “Air Content of Freshly Mixed Concrete by the Volumetric Method“
16. C231, “Air Content of Freshly Mixed Concrete by the Pressure Method“
17. C233, “Standard Method of Testing Air-Entraining Admixtures for Concrete“
18. C260, “Standard Specifications for Air-Entraining Admixtures for Concrete“
19. C441, “Standard Test Method for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to the Alkali-Aggregate Reaction“
20. C457, “Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete“
21. C494, “Standard Specifications for Chemical Admixtures for Concrete“
22. C670, “Preparing Precision Statements for Test Methods for Construction Materials“
23. C803, “Penetration Resistance of Hardened Concrete“
24. C1064, “Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete“
25. C1602, “Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete“

26. C1778, “Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete“

27. E96, “Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials“

28. E1745, “Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs“

C. Comply with building code requirements which are more stringent than the above and all OSHA requirements.

1.5 QUALITY ASSURANCE

A. Workmanship

The CONTRACTOR is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by the OWNER or ENGINEER. The CONTRACTOR shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

B. Concrete Testing Service

The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform material evaluation tests and to design concrete mixes. Per the OWNER or ENGINEER’s requirements the CONTRACTOR shall notify the designated representative to schedule the special inspections and materials testing required by the project documents.

C. Testing Requirements

Materials and installed work may require testing and retesting, as directed by the OWNER or ENGINEER, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times.

The costs for preparation of mix designs (if required by the OWNER to be performed by an independent testing laboratory) and testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

D. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.

3. Submit written reports to the OWNER and ENGINEER, for each material sampled and tested prior to the start of work. Provide the project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

4. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. The materials producer and the CONTRACTOR must sign certificates of compliance.

E. Allowable Tolerances:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

   a. Variation from plumb in lines and surfaces of columns, piers, walls and rises; 1/4-inch per 10 feet, but not more than 1-inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.

   b. Variation from level or grade in slab soffits, ceilings, beam soffits, and rises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum, and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum and 1/2-inch in 40 feet or more.

   c. Variation from position of the linear lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum, and 1-inch in 40 feet or more.

   d. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

   e. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.

   f. Variations in footing plan dimensions, minus 1/2-inch and plus two (2) inches; misplacement or eccentricity, two (2) percent of the footing width in direction of misplacement but not more than two (2) inches; thickness reduction, minus five (5) percent.

   g. Variation in steps - In a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

   h. Circular structures shall be constructed in a true circular form, with maximum variation of 1/4-inch from the dimensions shown on the plans.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

F. Quality Control Testing During Construction

See Section 3 - Execution.

1.6 CONCRETE MIX DESIGNS

A. All concrete materials shall be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier or if directed by the ENGINEER, mix proportions and concrete strength curves for regular cylinder tests, based on the relationship of 7, 14 and 28 day strengths versus slump values of two (2), four (4), and six (6) inches, all conforming to these Specifications, shall be established by an approved ready-mix supplier or an independent testing laboratory. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders.

Testing of concrete and materials shall be borne by the OWNER, except when materials do not meet specified requirements, in which case such costs shall be borne by the CONTRACTOR.

C. The exact proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mix design unless specifically so directed by the ENGINEER or Laboratory for improved specified strength or desired density, uniformity and workability.

D. The proportions of such mix design shall be based on a full cubic yard of hardened concrete.

E. Ready-mix companies or jobsite batch plants shall furnish delivery tickets, signed by a Certified Weighmaster, on which each shall state the weight of aggregates, sand, cement, admixtures and water and the number of cubic yards of concrete furnished, which will be compared against the approved mix design.

F. There shall be no variation in the weights and proportions of materials from the approved mix design.

G. There shall be no variation in the quality and source of materials once they have been approved for the specific mix design.

1.7 READY-MIXED CONCRETE

Ready-mixed concrete shall conform to the requirements of ACI 301 and ASTM C 94. In case of conflict, ACI 301 shall govern.

1.8 SAMPLE

Upon request by the OWNER or ENGINEER the CONTRACTOR shall pour and finish one 2-foot square exposed aggregate concrete sample for ENGINEER’s approval prior to construction if exposed aggregate is included on job.

1.9 JOB CONDITIONS

Maintain continuous traffic control and access for vehicular and pedestrian traffic as required for other construction activities as well as to adjoining facilities for regular operation. Utilize flagmen, barricades, warning signs and warning lights as required, to maintain a safe entrance and passage on all roads or drives abutting the project.

PART 2 PRODUCTS

2.1 WALL FORMS

A. Full Height Pours: The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

B. Wall Form Ties

1. Form ties which remain in the wall of a subgrade water-retaining structure shall have waterstops and a 1.5 inch minimum breakback or cone depth.

2. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

3. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess.

4. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.

C. Wall Form Stiffeners

1. Horizontal walers shall consist of structural steel channels, angles or tubing of adequate size to retain the concrete without deflecting.

2. As required the walers shall be rolled or welded to the proper radii or offset brackets shall be used for shaping the wall to the dimensions shown on the Drawings and shall be used both for inside and outside wall forms in direct contact with the wall panels and at vertical spacings of no more than 96 inches on center.

3. There shall be at least one such waler within 24 inches of the top and bottom of the wall.

4. The largest dimension of the steel waler shall be in the radial direction.

5. Vertical structural steel or wood members shall be spaced so as to have sufficient rigidity and strength to insure the proper vertical alignments with the aid of braces under all predictable stress conditions.

6. In lieu of the above, a different system and spacings may be used if it is satisfactorily demonstrated to the ENGINEER that it will be equally effective.

2.2 FORMS FOR EXPOSED FINISH CONCRETE

Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide

continuous, straight, smooth, exposed surfaces. Finish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection. Use overlaid plywood complying with U.S. Product Standard PS-1 “B-B High Density Overlaid Concrete Form”, Class I. Use flexible spring steel forms or laminated boards free of distortion and defects to form radius bends as required.

2.3 FORMS FOR UNEXPOSED FINISH CONCRETE

A. Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.

2.4 FORM MATERIALS

A. Form Coatings

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound. Petroleum based coatings shall not be used for structures in creeks and waterways. Biodegradable coatings shall be used which will not contaminate the creeks/waterways or an alternate method for stripping the form shall be proposed.

B. Chamfers, Reveals, Drips

Provide preformed PVC or shaped wood or metal of size and profile as shown on drawings.

C. Cylindrical Columns and Supports

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide units having “seamless” interior to minimize spiral gaps or seams.

D. Pan Forms

Provide forms for concrete pan-type construction complete with covers and end enclosures to form a true, clean, smooth concrete surface. Design units for easy removal without damaging placed concrete. Block adjoining pan units if required to avoid lateral deflection of formwork during concrete placement and compaction. Provide standard or tapered end forms, as shown.

If required, factory-fabricate pan form units to required sizes and shapes of the following:

1. Steel - 16 gauge minimum, free of dents, irregularities, sag and rust, or

2. Glass-Fiber Reinforced Plastic - Molded under pressure with matched dies, 0.11 inches minimum wall thickness.

E. Inserts & Embeds

Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work. The CONTRACTOR is responsible for

insuring that all required anchorage not specified in the project documents is installed per current building code and applicable ICC report requirements.

2.5 REINFORCING MATERIALS

A. See Section 03 21 00 – Reinforcing Steel for additional information.

B. Reinforcing Bar (rebar): ASTM A615 or ASTM 706 and as follows below.

Stirrups and Ties	Grade 60
All other Uses	Grade 60

C. Steel Wire: ASTM A1064, plain, cold-drawn, steel.

D. Welded Wire Fabric (WWF): ASTM A1064, welded steel wire fabric.

E. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Wood, brick, concrete blocks and other devices **will not** be acceptable. For slabs-on-grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are hot-dip galvanized, after fabrication, or plastic protected or stainless steel protected.

F. Fiber Reinforcement – Collated polypropylene fiber, ¾”-inch, manufactured from 100% virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116.

2.6 CONCRETE MATERIALS

A. Portland Cement

ASTM C150, Type II unless otherwise acceptable to ENGINEER. Use only one (1) brand of cement throughout the project, unless otherwise acceptable to the ENGINEER. The use of ground granulated blast furnace slag is not allowed.

B. Aggregates

ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the ENGINEER.

1. Fine Aggregate - Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

2. Coarse Aggregate - Clean, uncoated, processed aggregate containing no clay, mud, loam or foreign matter, as follows:

   a. Crushed stone processed from natural rock or stone.

   b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

   c. Maximum Aggregate Size - Not larger than one-fifth (1/5) of the narrowest dimensions between sides of forms, one-third (1/3) of the depth of slabs, nor three-fourths (3/4) of the minimum clear space between individual reinforcing bars or bundles of bars.

3. These limitations may be waived if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

4. In general it is desired that normal commercial mixes using 1-1/2-inch or 3/4-inch maximum aggregate size be used.

5. Aggregate for exposed aggregate concrete shall consist of selected aggregate of washed clean river gravel in color range of medium to dark in browns and grays; material uniformly sized 5/8-inch to 3/4-inch.

C. Water; Clean, fresh, potable: ASTM C1602.

D. Air Entraining Admixture: ASTM C260.

E. Water-Reducing Admixture: ASTM C494, Type A or F

F. Set-Control Admixtures: ASTM C494, as follows:

1. Type B, Retarding.
2. Type C, Accelerating.
3. Type D, Water-reducing and Retarding.
4. Type E, Water-reducing and Accelerating.

Calcium chloride will not be permitted in concrete, unless otherwise authorized in writing by the ENGINEER.

2.7 RELATED MATERIALS

A. Waterstops

1. Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints as shown. Size to suit joints or as shown. Provide PVC waterstops complying with Corps of Engineer's CRD-C 572.

2. For new concrete cast against existing concrete provide a non-bentonite, hydrophilic waterstop with a CJ-0725-3K profile.

B. Bituminous and Fiber Joint Filler

Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D1751, FS HH-F-341, Type 1 and AASHTO M 213. Provide one of the

following products:

1. Elastite; Philip Carey/Celotex
2. Flexcell; Celotex Corp.
3. Crane Fiber 1390; W.R. Grace & Co.
4. Fibre; W.R. Meadows, Inc.
5. Tex-Lite; J & P Petroleum Prod. Inc.
6. Sonoflex; Sonneborn/Contech, Inc.

C. Form Ties (for forms other than wall forms)

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1.5 inches inside concrete. Unless otherwise shown, provide form ties, which will not leave holes larger than 1-inch in diameter in concrete surface.

D. Concrete Curing Materials

Concrete curing materials shall be in accordance with ACI 301 Section 5 and ACI 308.1 Section 2.

1. Water-based resin curing compound. W.R. Meadows, Inc. 1100; Euclid Kurez DR VOX; or approved equal.
2. Acrylic curing and sealing compound. W.R. Meadows, Inc. CS-309-30, or approved equal.
3. Water emulsion acrylic curing and sealing compound formulated of acrylic polymers of water-based carrier. W.R. Meadows, Inc. VOCOMP-20, Euclid Luster Seal WB, or approved equal.

E. Epoxy Adhesive

For application to wire-brushed and prepared existing concrete to be mated to new concrete.

1. W.R. Meadows, Inc. INTRALOK, Sika Sikadur-32 Hi-Mod, Sika Armatec-100 EpoCem, or approved equal.
2. Apply per manufacturer’s recommendations.

F. Chemical-Hardener Finish: Provide **W.R. Meadows, Inc. Liqui-Hard (interior surfaces)** or approved equal.

G. Non-slip Aggregate Finish

Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof and non-

glazing, and is unaffected by freezing, moisture and cleaning materials.

2.8 PROPORTIONING NORMAL CONCRETE

A. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1. All measurements shall be by weight. All concrete admixtures will either be by the same supplier to insure compatibility. If different suppliers are used a memorandum from EACH admixture supplier will be provided stating the compatibility of their product with the other supplier's products.

B. The slump shall be between two inches and four inches when tested in accordance with ASTM Specifications C 143. Variations in the slump range may be allowed by the ENGINEER if admixtures, such as water reducers or superplasticizers, are utilized in the concrete mix. Regardless of the measured slump, the maximum allowable water-cement ratios as specified here-in, shall be strictly adhered to.

C. Compressive Strength, Water and Cement Content

Notwithstanding what has been stated here-before, and unless shown otherwise on the Drawings, the concrete shall meet the following requirements. All concrete except as noted otherwise on the drawings shall have 4,500 psi 28-day compressive strength and a maximum water/cement ratio of 0.45. Up to a maximum of 15% of cementitious material may be fly ash in accordance with ASTM C618. The use ground granulated blast furnace slag is not allowed for any surfaces in contact with potable water.

D. Retarding Densifiers

1. All concrete (as defined in 2.9 below) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Const. Products, Cambridge, MA or MBL-82, as manufactured by Master Builders, Cleveland, OH in the amounts recommended by the additive manufacturer whenever the air temperature during the pour exceeds 85° F.

2. To be considered as equal, any alternate product offered for consideration shall contain no calcium chloride and shall be compatible with air-entrained cements and air-entraining admixtures conforming to the applicable ASTM, AASHTO, ANSI and Federal specifications.

3. CONTRACTOR shall certify that admixtures do not contain calcium chlorides or other corrosive materials.

E. Air-Entraining Agents

1. All concrete that that is specified to be air entrained or that may be exposed to freeze/thaw action either during construction or the service life of the structure must be air entrained.

2. Air-entraining agents shall meet ASTM C 260, ASTM C 233 and ASTM C 457.

3. The total volumetric air content of the concrete before placement shall be six (6) percent +/- 1.5 percent as determined by ASTM C 173 or ASTM 231 for mixes using a 3/4"nominal aggregate size.

4. Subject to these Specifications, consideration will be given to the following products: PROTEX “AES,” GRACE “DAREX AEA,” MASTER BUILDERS “MB-AE10,” or SIKA CHEMICAL “AER.”

F. Water Reducing Admixtures

1. In addition to air-entrainment, approved water reducing additives, which do not affect the ultimate performance of any steel in any way, may be added to maintain the maximum water content below that specified herein. Water reducing additives shall conform to ASTM C 494, Type A or D.

2. The use of water reducing additives shall not permit a reduction in the minimum specified cement content or in the specified amount of air-entrainment.

3. Admixtures shall contain no calcium chloride, tri-ethanolamine or fly ash. All admixtures shall be from the same manufacturer.

4. Superplasticizers, if allowed by the ENGINEER, shall conform to ASTM C 494, Type F or G, batch plant added using second or third generation only.

5. Set control admixtures if allowed by the ENGINEER, shall conform to ASTM C 494, Type B (retarding) or Type C (accelerating).

2.9 CONCRETE MIXING

A. Ready-Mix Concrete

1. Comply with the requirements of ASTM C94, and as herein specified. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When the air temperature is between 85°F and 90°F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90°F, reduce the mixing and delivery time to 60 minutes.

2. Minimum Mix Time: Once all materials are in the drum, the minimum mixing time shall be for 10 minutes before concrete is placed.

PART 3 EXECUTION

3.1 FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formworks so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formworks to be readily removable without impact shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures.

Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Erect falsework and support; brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures.

Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

F. Forms for Exposed Concrete

Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use metal cover plates for patching holes or defects in forms. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow. Assemble forms so they may be readily removed without damage to exposed concrete surfaces. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

Corner Treatment - Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise indicated.

G. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings of forms at inconspicuous locations.

H. Chamfer exposed corners and edges, reveals and drips as shown using wood, metal, PVC or rubber strips fabricated to produce uniform smooth lines and tight edge joints. A ½ inch chamfer at exposed edges is typical unless noted otherwise.

I. Provisions for Other Trades - Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such ties. Accurately place and securely support items built into forms.

J. Cleaning and Tightening - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.2 PLACING REINFORCEMENT

Detail and place according to ACI Manual SP-66. Unless otherwise noted, minimum cover shall be 1-1/2 inches for No. 5 and smaller bars, 2.0-inches for No. 6 and larger bars or for any bars exposed to exterior or wet environments, and 3.0-inches when poured against earth. Unless otherwise noted, bend all horizontals reinforcing a minimum of two (2) feet at corners and wall intersections.

A. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

C. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Do not place reinforcing bars more than two inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two (2) inches, and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 JOINTS

A. Construction Joints - Locate and install construction joints not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the ENGINEER. Install and locate other construction joints as specified.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Unless otherwise specified, reinforcement shall be lapped in accordance with ACI Standards.

C. Waterstops - Provide waterstops in construction joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with manufacturer’s printed instructions. Protect waterstop material from damage where it protrudes from any joint.

D. Isolation Joints in Slabs-on-Ground - Construct isolation joints in slabs-on-ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated.

E. Control Joints in Slabs-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4-inch wide by one-fifth (1/5) to one-fourth (1/4) of the slab depth, unless otherwise shown.

1. Form control joints by the following methods

a. Inserting a premolded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove of loose debris.

b. Saw cutting a control joint in the required location. Plan for saw cutting so work does not damage reinforcing or violate edge distance minimums.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General - Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs - Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

C. Cast in Place Reglets - Place in straight and continuous lines as detailed to enable flashing to be applied continuously without deviation at reglet joints more than 1/8-inch. Miter corners for continuous reglet joint where outside corners occur. At inside corners extend one section 1-inch past corner. Adequately anchor or secure reglets per manufacturer's instructions prior to pouring and during construction to insure dimensional tolerances and alignment. Vibrate concrete to insure concrete cover adjacent to and around reglet. Visually inspect after pour and patch as required.

3.5 PREPARATION OF FORM SURFACES

Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin formcoating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Use dissipating-type form oil at surfaces to receive cement plaster finish. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work as required. Notify ENGINEER in time for inspection prior to pouring.

2. Remove all garbage and debris from the base of formwork. Items such as aluminum cans, food containers, plywood, and their like are to be cleaned-up and disposed.

3. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

4. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

5. Concrete Curbs and Paving - Do not place concrete until subbase is completed and approved by the ENGINEER as required to provide uniform dampened condition at the time concrete is placed. Moisten subbase as required to provide uniform dampened condition at the time concrete is placed.

B. Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure, which will cause segregation.

2. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable or does not meet the required quality control limits or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location. Do not use concrete whose allowable mixing time has been exceeded.

C. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

3. The CONTRACTOR shall provide traffic control on the narrow access roads to the work sites.

4. The CONTRACTOR shall not wash concrete trucks/chutes/equipment off at the project site unless plastic tarps and hay bales are employed to contain the concrete. The CONTRACTOR will be required to haul off-site all concrete contaminated soil.

D. Placing Concrete into Forms

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Do not interrupt successive placement; do not permit cold joints to occur.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.

5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete at least six (6) inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

E. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment so the concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

4. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

F. Bonding

1. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and not to leave laitance, loose particles of aggregate or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

a. At joints between footings and walls or columns, and between walls or columns and beams or slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

b. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids; dampen, but do not saturate the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.

c. Use neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than six (6) gallons of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16-inch. Deposit fresh concrete before cement grout has attained its initial set.

d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the bonding material manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin-bonding agent as follows:

a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.

b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16-inch thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

G. Cold Weather Placing

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.

2. When the air temperature has fallen to or is expected to fall below 40°F, provide adequate means to maintain the temperature in the area where concrete is being placed at either 70°F for three (3) days or 50°F for five (5) days after placing. Provide temporary housing or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Keep concrete moist. Avoid rapid dry-out of concrete due to over-heating and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50°F, and not more than 80°F, at point of placement.

4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing

steel and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 FINISH OF FORMED SURFACES

A. Rough Form Finish

For formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth Form Finish

Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view. Or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Curb Finishes

Curbs shall be screeded off accurately to true lines and planes or warped surfaces as indicated or directed. Finish smooth. Arises shall be true and straight or properly eased where curved and neatly rounded with approved tool. Smooth trowel finish with corners rounded to 3/4-inch radius.

D. Grout Cleaned Finish (Sacked)

Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment, and to all exposed to view interior and exterior building surfaces, typical.

Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces

At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.8 MONOLITHIC SLAB FINISHES

A. Float Finish

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing or sand bed terrazzo, and as otherwise shown on drawings or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill at low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, paint, or other thin-film finish coating system.

2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Exposed Aggregate Finish

1. Screed to true plane, bullfloat surfaces, provide uniform double troweled finish. After troweling, let set until hard enough to wash without disturbing coarse aggregates. Simultaneously brush and spray with water to expose large aggregate and produce texture to match approved sample. Water cure or keep wet for 25 hours.

2. Scrub surface after 24 hours with a one (1) part muriatic acid to10 part water solution. Rinse thoroughly.

D. Broom Finish (Non-Slip)

1. Apply non-slip, broom finish to exterior concrete platforms, steps and ramps and elsewhere as shown on the drawings or in schedules.

2. Immediately after trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or in the direction of water flow. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the ENGINEER before application.

E. Chemical-Hardener Finish

1. Apply chemical curing-hardening compound or chemical-hardener to all interior concrete floors which will not receive applied finish materials. Mask adjacent work and surfaces to avoid over spray. Apply liquid chemical-hardener after complete curing and drying of the concrete surface.

2. Dilute the liquid hardener with water and apply in accordance with the manufacturer's printed directions. Evenly apply each coat and allow for drying between coats in accordance with manufacturer's printed directions.

3. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

F. Non-slip Aggregate Finish

Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the drawings or in schedules.

After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force the non-slip aggregate particles below surface. After broadcasting and tamping, apply trowel finish as herein specified. After curing, lightly work the surface with a steel wire brush, or an abrasive stone, and water to expose the non-slip aggregate.

Schedule of Concrete Surface Finishes

Surface Description	Type	Finish Requirement
A. Exterior Vertical Surfaces Exposed to View	Formed	Smooth Form

3.9 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for the time period and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

Perform curing of concrete by moisture curing (continuous wetting), by moisture-retaining cover curing (damp sand, burlap, canvas, or straw), by liquid membrane curing (liquid membrane-forming compound) or covering concrete with protective sheet materials (polyethylene plastic sheeting “visqueen” or similar) or by combinations thereof, as herein specified. Provide the curing methods indicated as follows:

1. For concrete floor slabs provide moisture curing, moisture cover curing or liquid membrane/chemical curing-hardening curing. If liquid membrane curing is used, it must be compatible with concrete hardening compounds to be applied later.

2. For other concrete work, provide moisture curing, moisture-retaining cover curing, membrane curing, or protective sheet covering. Do not use liquid membrane or chemical curing-hardening curing on any concrete work to receive any applied finishes.

3. Inspect concrete, regardless of current method selected, do not permit the concrete to become surface-dry at any time. For formwork left in place, ensure the wood formwork is wetted throughout the curing process.

4. For curing, use only water that is free of impurities, which could etch or discolor exposed, natural concrete surfaces.

5. Provide moisture curing by any of the following methods:

    a. Keeping the surface of the concrete continuously wet by covering with water.

    b. Continuous water-fog spray.

6. Provide moisture-retaining cover curing by any of the following methods:

    a. Covering the concrete surface with the specified absorptive cover thoroughly saturated with water and keeping the absorptive cover continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges with a 4-inch lap over adjacent absorptive covers.

b. Use minimum 4 mil thickness, clear or translucent polyethylene sheets “visqueen” or similar.

c. Support sheet material to prevent marking of the concrete surface.

7. Provide liquid membrane curing as follows:

a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a coat continuous operation by power spray equipment in accordance with the manufacturer’s directions. Recoat areas, which are subjected to heavy rainfall within three (3) hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

b. Do not use membrane-curing compounds on surfaces, which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete. Such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the ENGINEER.

8. Curing formed Surfaces - Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

9. Curing Unformed Surfaces

a. Initially cure unformed surfaces, such as slabs, floor topping and other flat surfaces by moist curing, whenever possible.

b. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

c. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the ENGINEER.

10. Provide liquid curing-hardening compound as follows:

a. Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray or hair broom in accordance with manufacturer’s directions.

C. Temperature of Concrete during Curing

1. When the atmospheric temperature is 40°F and below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protections complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80°F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation wind breaks or shading, and for fog spraying, wet

sprinkling or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protections complying with the requirements of ACI 305.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete, which exceed 5°F in any one-hour and 50°F in any 24-hour period.

D. Curing Time

1. Cure concrete for the following times

a. ASTM C150 Type I concrete – Cure for 7 days after placement.

b. ASTM C150 Type II concrete – Cure for 10 days after placement.

c. ASTM C150 Type III concrete – Cure for 3 days after placement.

d. ASTM C150 Type IV and V concrete – Cure for 14 days after placement.

2. When permitted by the ENGINEER, curing operations can be ended once the results of two (2) cylinder tests show that the concrete has reached a strength of 85% f'c. However, no less than 3 days of curing shall occur.

E. Protection from Mechanical Injury - During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In - Fill-in holes and openings in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Curbs - Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations - Provide machine and equipment bases and foundations as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

3.11 REMOVAL OF SHORES AND FORMS

A. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work without excessive stress or deflection.

Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until the concrete has attained its required 28-day strength and heavy loads due to construction

operations have been removed.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulative curing at not less than 50°F for 24 hours after placing concrete. Providing the concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

D. Form facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Re-Use of Forms

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to the Architect.

No forming material will be allowed to be built permanently into exposed visible surfaces.

3.12 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas

1. Repair and patch defective areas with cement mortar immediately after removal of forms but only when directed by the ENGINEER.

2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter and holes left by tie rods and bolts down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the ENGINEER.

3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces

1. Repair exposed-to-view formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the ENGINEER. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolt; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01-inch wide, cracks or any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

C. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so those repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the ENGINEER.

6. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating, or use concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair single holes not over 1 inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part

Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. Repair isolated random cracks.

9. For repair of existing unformed surfaces, mechanically remove all lose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate free, open textured surface. Square cut or under cut perimeter to minimum depth as specified by the repair mortar manufacturer. Remove all lose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25%. Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be repaired per manufacturer's requirements, such as Sika Armatec 110 . Apply a polymer-modified, cement-based, repair mortar, trowel applied as specified by the manufacturer, such as Sika MonoTop 615.

10. Repair methods not specified above may be used subject to the acceptance of the ENGINEER.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The OWNER or a representative of the OWNER will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the OWNER, ENGINEER, and the CONTRACTOR.

B. Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete - ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump Test - ASTM C143; one (1) test for each set of compressive strength test specimens. Samples shall be taken at point of discharge.

3. Air Content - ASTM C231, pressure method; one (1) for each set of compressive strength test specimens.

4. Compressive Strength Test Specimen - ASTM C31; One (1) Set which consist of a minimum of four (4) standard cylinders to allow for compressive strength testing, unless otherwise directed. If early loading of members or sections is desired by the CONTRACTOR, additional tests cylinders shall be collected for testing. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

5. Concrete Temperature – ASTM C1064, Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.

6. Compressive Strength Tests - ASTM C39; One (1) Set for each 100 cubic yards or fraction thereof, of each concrete class placed in any one (1) day, OR for each 5,000 square feet of surface area placed, OR as per minimums outlined below.

   a. When the frequency of testing will provide less than five (5) Sets of cylinders by which to perform strength tests for a given class of concrete, conduct testing, as follows.

      1) For a class of concrete with a total batch size of greater than 500 cubic yards or 25,000 square feet of surface area, collect test Sets as outlined above.

      2) For a class of concrete with a total batch size of less than 500 cubic yards or 25,000 square feet of surface area, but greater than 300 cubic yards or 15,000 square feet of surface area, collect four (4) Sets for testing. Two (2) Sets near the beginning of pouring, one (1) Set mid-way through pouring and one (1) Set towards the end of pouring.

      3) For a class of concrete with a total batch size of less than 300 cubic yards or 15,000 square feet of surface area, but greater than 50 cubic yards or 2,500 square feet of surface area, collect three (3) sets of testing. One (1) Set near the beginning of pouring, one (1) Set mid-way through pouring and one (1) Set towards the end of pouring.

      4) When the total quantity of a given class of concrete is less than 50 cubic yards, and NO anchors are embedded in the concrete, the ENGINEER may waive the strength tests if, in their judgment, adequate evidence of satisfactory strength is provided. Otherwise testing shall occur as outlined in 3.14.B.6.a

   b. Testing Procedure: A Set of specimens with yield four (4) cylinders. Therefore, five (5) Sets will yield 20 cylinders, four (4) Sets will yield 16 cylinders, three (3) Sets will yield 12 cylinders, From each set test one (1) cylinder at seven (7) days, test two (2) cylinders at 28 days, and one (1) cylinder shall be retained in reserve for later testing if required. Additional cylinders can be obtained, at the CONTRACTOR's or OWNER's discretion, for testing at alternate times.

   c. If required by the building official, perform strength tests of cylinders cured under field conditions. Field cured cylinders shall be taken and molded at the same time and from the same samples as the laboratory cured test cylinders. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

C. Report test results in writing to the ENGINEER and the CONTRACTOR on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of CONTRACTOR, name of concrete supplier and concrete mixing truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests.

D. Additional tests - The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the ENGINEER. The testing service shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other

methods as directed. CONTRACTOR shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Provide structural steel members, including all anchor bolts and other devices required for installation.

B. Shop fabricate miscellaneous steel and iron work, including brackets, braces, angles, lintels, anchors, supports, or other items shown on Drawings for support or connection of other work.

C. Furnish items to other trades when setting and installation is part of their work.

D. A list of items needed for the construction of the building are herein specified and constitutes a description of the type of materials necessary to fabricate such items. However, this does not imply that each individual item on the job is herein listed.

E. All exterior steel shall be Hot Dip Galvanized per Section 2.2 below.

1.2 REFERENCES

A. The American Institute of Steel Construction (AISC).

B. American Society for Testing and Materials (ASTM).

C. The American Welding Society (AWS).

D. The Society for Protective Coatings (SSPC).

1.3 SUBMITTALS

A. Shop drawings detailing fabrication of structural steel components.

B. Cross reference shop drawing details to detail numbers on the Drawings to facilitate checking.

C. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

D. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

E. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

F. Provide AWS certificate copy for all welders. Submit to Architect prior to fabrication.

G. Welding procedure specifications (WPS) for all different welding types and fit-ups.

H. Provide mill certificates attesting to grades of structural steel, steel tubing and pipe.

1.4 DELIVERY STORAGE AND HANDLING

A. Store material at the project site above the ground on platforms, skids or other supports, and protect from corrosion. Store nuts, bolts, washers, grout, welding rods and other materials in weathertight and dry location. Keep packaged materials in original, unbroken containers.

B. Structural steel at job site without inspection certificate or erection marks will be rejected.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes: ASTM A36, or ASTM A572 Grade 50 where indicated, standard rolled sections of size and weight fabricated as detailed.

1. W and WT Shapes: ASTM A992, Grade 50.

2. Other Rolled Shapes: ASTM A36.

3. Structural Steel Plates and Bars: ASTM A572, Grade 50.

4. Square and Rectangular HSS: ASTM A500, Grade C (Fy = 50ksi).

B. Ledgers, Angle Frames, Headers, and Blocking: ASTM A36, standard rolled section of size and weight fabricated as detailed.

C. Plates, Clips, Hangers and Brackets: ASTM A36, or ASTM A572 Grade 50 where indicated, standard rolled shapes and sections fabricated to sizes and dimensions as detailed.

D. Anchor Rods, Bolts, Screws, Nuts and Washers:

1. Headed Rods: ASTM F1554, Grade 36 and Grade 55, as noted

2. Headed Bolts: ASTM A325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.

3. Bolts: ASTM A325N or A490N bolts for structural bolting and ASTM A307 bolts where noted as machine and anchor bolts.

4. Screws: ASTM C954, No. 10 diameter by length required to penetrate steel flange by not less than 3 exposed threads and with polymer coating.

5. Nuts and Washers: Nuts and washers for all bolted connections. ASTM A36.

6. Finish: Hot-dip galvanized finish ASTM A153 Class C when installed with galvanized items.

E. High-Strength Bolts, Nuts and Washers: ASTM A325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Hot-dip zinc-coating, ASTM A153, Class C, unless noted otherwise.

F. Welding Electrodes: Comply with AWS requirements.

G. Expansion Anchors:

1. Description: Zinc plate finish at interior exposure, stainless steel at exterior exposure.

2. Manufacturers: "Kwik Bolt TZ" by Hilti, "Ramset/Redhead TruBolt" by ITW or engineer approved equal

2.2 GALVANIZING

a. Galvanize all items for exterior use or exposed to weather, in preparation for paint finish.

b. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

c. Minimum 85 grade.

B. Threaded Concrete Anchors:

1. Description: ASTM F593 Gr.2 CW2 Stainless Steel.

C. Epoxy Concrete Anchors:

1. Description: Zinc plate finish.

2. Manufacturers: "HIT RE-500" by Hilti or engineer approved equal.

2.3 FINISHES

A. Hot-dip galvanized finish ASTM A123, Coating Grade 60, for all steel and iron items exposed in exterior locations, and elsewhere as detailed, except for steel scheduled to receive "special paint," shall be primed with Tnemec "90-97" or Carboline "859" at 3 mils dry film thickness after being surface prepared in accordance with SSPC SP-6. One shop coat rust inhibiting primer paint on all other items whether concealed or exposed, except do not prime surfaces to be bonded into concrete or masonry, at friction-type bolted connections, surfaces within 2-inches of bolts or welds, or surfaces to receive shear studs.

2.4 FABRICATION

A. Incorporate minimum reference standard for fabrication and erection; AISC Specifications.

B. Cut shapes to pattern, sizes, and dimensions as detailed and approved. Punch and drill holes accurately, maintaining proper edge and end clearance and proper diameter to fit each fastening. Countersink holes for flat head wood screws.

C. Camber structural steel members where indicated.

D. Remove rust, scale, grease and oil after fabrication and prime paint.

E. Furnish and shop assemble all items true to measurements taken at the job, disassembled and ship to the job, complete with all sleeves, bolts, etc., necessary for erection.

F. Mark each member or assembly of members with erection marks for identification; furnish an erection diagram with marks shown. Load structural members or assembled units in such a manner that they may be transported and unloaded without being excessively stressed, deformed or otherwise damaged. Place fabricated material on skids, off the ground; keep clean and properly drained.

G. All welding performed by certified welders and in accordance with AWS Code. Grind welds on architecturally exposed items to make smooth and flush when ready for paint finish.

H. Grind exposed ends and cut edge of all items smooth and slightly beveled to remove sharpness, burrs, and cutting marks. Use gas cutting torch in the field to cut holes or correct fabrication errors only after submitting each condition to Architect for review.

PART 3 EXECUTION

3.1 ERECTION

A. Comply with the AISC Specifications and Code of Standard Practice, with specified requirements.

B. Use special care in unloading, handling, and erection, to avoid bending, twisting, or otherwise distorting the members. Plan and execute the erection in such a way that the close fit of the joints and the structure as a whole will not be impaired.

C. Do not set permanent bolting or welding until as much of the structure as will be stiffened thereby has been properly aligned and within tolerances.

D. At completion of erection, touch-up paint bolts and field welds and abrasions with the same paint used for shop painting. Repair galvanized steel in accordance with ASTM A780.

3.2 FIELD ASSEMBLY

A. Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of the structure within AISC tolerances.

B. All beams and girders shall be cambered as indicated on the Drawings. Where no camber is specified, natural camber of the member shall be up, opposite for cantilevers.

C. Splice members only as detailed or specified.

D. Provide temporary bracing where necessary to take care of loads to which the structure may be subjected, including erection equipment, and its operation. Leave bracing in place as long as may be required. Concrete walls and floors are required for stability of the steel frame.

E. Bolt using high-strength threaded fasteners. Assemble in accordance with AISC Specification for Structural Joints, including Supplement No. 1, March 11, 1986, using ASTM A325N and ASTM A490N bolts.

F. Provide angle frame headers and blocking (or other standard shapes if detailed otherwise) at steel deck penetrations, sized for span and dead/live loading to match adjacent deck loading design.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections: The Owner will employ the services of an independent testing laboratory for performing tests and to conduct inspection services on all shop fabricated and on-site structural welding and bolting plus expansion anchor, grouted anchor, and adhesive anchor placement required for this construction.

END OF SECTION

SECTION 05 31 00
METAL DECK

PART I GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Metal decking as indicated on the Drawings.
2. Composite Metal Deck.
3. Support Framing.
4. Connections.
5. Accessories.

1.2 RELATED SECTIONS

A. Division 01 Section Submittal Procedures.

B. Division 01 Section Quality Requirements.

C. Division 03 Section Cast-in-Place Concrete.

D. Division 05 Section Structural Steel.

1.3 REFERENCE STANDARDS

A. General: The latest versions of the publications listed below form a part of this Specification; comply with provisions of these publications except as otherwise shown or specified.

B. American Iron and Steel Institute (AISI):

AISI Specification for the Design of Cold-Formed Steel Structural Members

C. American Society for Testing and Materials (ASTM):

ASTM A36 Structural Steel
ASTM A108 Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A653 Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process
ASTM A611 Standard Specification for Structural Steel (SS) Sheet, Carbon, Cold Rolled
ASTM A924 General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process

D. American Welding Society (AWS):

AWS D1.1 Structural Welding Code - Steel
AWS D1.3 Structural Welding Code - Sheet Steel

E. Steel Deck Institute (SDI):

SDI Design Manual for Composite Decks, Floor Decks, and Roof Decks

F. Underwriters' Laboratories (UL) Fire Resistance Manual

G. Factory Mutual (FM) Research Corporation Approval

1.4 QUALITY ASSURANCE

A. Qualification of Erector/Installer: Must have a minimum of five years experience in the installation and/or erection of metal decking and accessories.

B. All deck material and connections are to have current ICBO approvals.

C. Each welder performing work on this project shall be qualified in accordance with the American Welding Society before commencement of welding on this project. Welds are to be performed by Washington Association of Building Officials (WABO) certified welders.

D. Unless otherwise noted, the materials of this Section are used as part of an assembly in which fire-resistive construction ratings are required. Demonstrate rated approval by Underwriter's Laboratories, Inc., and the governmental agencies having jurisdiction.

E. See Division 01 Section Quality Requirements for testing and inspection.

F. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

G. Factory Mutual (FM) Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings for the plan deck spans.

H. Pre-Construction Conference: Schedule a job conference to review the Structural Documents prior to development of shop drawings. The conference shall be attended by all pertinent parties, which at a minimum is to include the Fabricator, Erector, Contractor, Owner's Testing Agency, and Structural Engineer.

1.5 SUBMITTALS

A. Submit the following in accordance with Division 01 Section Submittal Procedures.

B. Shop Drawings: Clearly indicate the following:

1. Deck layout and orientation, type and gage, framing and supports, and unit dimensions and sections.
2. Size and location of holes and openings through deck.
3. Edge condition details and locations, including type and locations of all closures.
4. Additional deck support framing where required.
5. Types of welds and weld patterns, including weld washer requirements.
6. Types of connection fasteners and locations.
7. Location and patterns for button punching.
8. Layout of steel shear connector studs.
9. Shoring locations, if required.

C. Manufacturer's Product Data: Clearly indicate all technical information that specifies full compliance with requirements of this Section and contract documents, including manufacturer's published installation recommendations.

D. Copies of each welder's qualification records shall be made available to the Architect for inspection.

E. Mill Test Reports: Submit mill test reports.

F. Submit ICBO Report confirming compliance of metal deck with regulatory fire-resistance requirements.

1.6 HANDLING AND STORAGE

A. Handling: Handle and stack all materials carefully in order to prevent deformation or damage. During unloading and hoisting, extra care shall be given to prevent damage to the ends and sides. Decking shall not be placed in direct contact with the ground. Store deck at a slope to prevent water from ponding. Where the underside of deck is architecturally exposed, it shall be

free from visual defects such as scratches, dents, flame cut edges, holes, etc. All damaged deck shall be replaced.

B. Damaged Units: The Contractor shall replace damaged deck units that are rejected by the Owner's Testing Agency. All rejected deck shall be immediately removed from the job site.

1.7 JOB CONDITIONS

A. General: Conform to all local, state and federal safety regulations, especially where decking is used as planking prior to welding in place. Exercise extreme care so as to prevent decking from blowing off in wind.

1.8 CONDITION OF STEEL

A. Pre-Fireproofing Inspection: The Contractor, metal decking erector, sprayed-on fireproofing applicator, and the Owner's Testing Agency shall conduct a visual inspection of all metal decking prior to receiving fireproofing. The purpose of this inspection is to check for foreign substances on the surfaces that could impair adhesion. Any cleaning that may be necessary as a result of this inspection shall be done at no additional cost to the Owner.

1. All metal decking shall be free of oil, dirt, or other materials that will impair bond of concrete or fireproofing.
2. Application of the sprayed-on fireproofing will not commence until all steel surfaces have been accepted by sprayed-on fireproofing subcontractor and material manufacturer. No additional compensation shall be granted to the Contractor, metal decking erector, or fireproofing applicator should it be determined at a later date that foreign substances that were allowed to remain on the steel surfaces will have a detrimental effect in obtaining total adhesion in accordance with the fireproofing Specification Section.

1.9 REQUIREMENTS AT EDGE CONDITIONS

A. The Contractor shall make specific provisions to provide the necessary framing materials at slab and roof edge conditions. The Contractor shall provide and install all gauge metal edge closures where required by the plans and specification and shall coordinate shoring requirements at composite slab edges. The Contractor shall provide and install all structural steel bent plate edge closures or structural steel edge materials and any corresponding bracing or shoring where required by the plans and specifications.

B. At edge closures, provide necessary modifications to the edge closure to ensure that shear connector studs can be properly connected to the structural framing. Where possible, weld through the edge closure. Where this is not possible or where an inadequate weld occurs, cut the edge plate at each stud and connect the stud directly to the framing.

PART II PRODUCTS

1.1 MATERIALS AND COMPONENTS

A. Galvanized Composite Steel Deck

1. Material: Composite floor deck shall be galvanized steel conforming to ASTM A653 Grade 33 Fy (min) = 33,000 psi with a G60 coating of zinc prior to being formed. Furnish decking of depth and profile as indicated on the drawings.
2. Gage of deck and minimum connections shall be determined by the Contractor based on the span conditions, unshored condition, and the superimposed loads shown on the drawings, load diagrams, and notes. Minimum gauge is 20. The capacities of the deck shall be based on current ICBO reports.

3. For floor deck indicated as part of a fire rated system, furnish decking listed in the UL "Fire Resistance Directory" and bearing the UL label for the system detailed.
4. Fabricate composite deck units with integral embossing or raised patterns to provide mechanical bond with concrete slabs.
5. Furnish deck panels of lengths required to span continuously over four or more supports (3 spans) unless framing does not allow for such layout.
6. Furnish deck panels with butted end conditions and interlocking side laps, unless otherwise noted.
7. Furnish deck with UL approved tabs or clips for hanging loads:
    a. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
    b. Provide manufacturer's standard hanger attachment devices.
8. Furnish deck panels with provisions for venting through the deck ("vent deck") for slabs that are to receive impervious coatings such as roofing materials or waterproof membranes.

B. Roof Deck

1. Material: Metal roof deck shall be galvanized steel conforming to ASTM A653 Grade 33 Fy (min) = 33,000 psi with a minimum G60 coating of zinc prior to being formed or ASTM A611 Grade C or D with Fy (min) = 33,000 psi with primed and painted surfaces where specified as being painted per the Architect. Furnish decking of depth, gauge, and profile as indicated in drawings with all connections as indicated in the drawings and notes.
2. Where the deck and connections are not sized on the drawings, they shall be designed by the Contractor to satisfy the requirements of the plan superimposed vertical gravity and uplift loads in conjunction with the required diaphragm capacity as indicated in the load maps and notes. The minimum deck gauge is 20. Total load deflections shall be limited to L/360. The capacities of the deck and its connections shall be based on current ICBO reports.
3. Uplift Loading: Steel roof deck and its connections to the supporting steel members shall be capable of resisting uplift loads of 25 pounds per square foot or the loads indicated on the load maps, whichever is greater.
4. For deck indicated as part of a fire rated system, furnish decking listed in the UL "Fire Resistance Directory" and bearing the UL label for the system detailed.

C. Connections: Connections shall be determined by the Contractor based on the more stringent of the manufacturer's minimum recommendations for the plan configurations and loading or as specified in the contract documents. Connections may be made by any method recommended by the manufacturer, except that button punching of side laps shall not be allowed at roof decks unless indicated specifically as being required per the Structural Plans. Connection materials shall be as follows:

1. Welded Shear Connectors: ASTM A108, Grade 1015 or 1020; of dimensions complying with AISC specifications and the contract drawings; through deck stud welded shear connectors. Install in such a manner as to provide complete fusion between the end of the stud and structural steel base material.
2. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
3. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
4. Welding Materials: Applicable AWS D1.1 and D1.3 type required for materials being welded.
5. Weld Washers: Provide as required per manufacturer's recommendations.

D. Support Framing: Where necessary to provide support of the deck at edges of openings and at columns, additional support framing shall be provided by the Contractor per the typical details so that the deck flutes are supported with a minimum 2 inches of bearing. Where no details are provided or are not applicable, the Contractor shall design and provide secondary structural steel framing consisting of ASTM A36 steel to support the deck. The secondary framing shall satisfy the requirements of Section 05120, “Structural Steel.”

E. Accessories: At roof and composite floor slab conditions, the Contractor is to design and provide all accessories of types required to complete the installation of metal decking in the system shown, including edge forms, end closures, sump pans, closure strips, cover plates, etc. Finish sheet metal items to match deck. Include the following items:

1. Metal cover plates to close gaps at changes in deck direction, columns, walls, and openings; 20 gauge minimum.
2. Continuous sheet metal edging at openings and concrete slab edges, 20 gauge minimum or as required per plan.
3. Sealed closures for ends of cells on single-unit decking, 20 gauge minimum.
4. Fabricate metal closure strips of 20-gauge sheet steel for openings between decking and other construction. Form to provide tight fitting closures at open ends of cells or flutes, sides of decking, and between decking.

F. Shear Connectors: Where the deck capacity is determined based on the installation of shear studs, the shear studs required on the framing plans for composite beams or other connections to structural framing shall not be considered to be effective in determining the deck capacity. Shear studs, which are in addition to those required per plan, shall be provided as required by the deck manufacturer to achieve the required deck capacity, provided these additional studs can be placed on the beam without adversely effecting the shear value of the studs that are required per plan.

PART III EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 TOLERANCES

A. Unless otherwise noted, edge materials shall be field installed to the minimum tolerances of this Section or as required for the installation of the cladding system, whichever is more stringent.

1. Edge Location: ±1/2 inch from established building working lines.
2. Edge Height: ±1/8 inch from established slab thickness

3.3 INSTALLATION

A. General: Install decking in accordance with approved shop drawings and manufacturer's recommendations. Where metal deck is to be welded to steel framing with puddle welds or shear studs, the steel framing shall be free of dirt and debris prior to laying the metal deck. Any water in the deck's valley shall be released so it does not become entrapped between the deck and the beam. The deck shall be installed so that the bottom rib is in continuous contact with the steel framing.

B. Accurately align and adjust steel panel units in place before permanently fastening. Provide butt end spliced, do not overlap ends of deck. Inaccuracies in alignment or level shall be

brought to the attention of the Architect and corrected by the Contractor before steel panels are finally placed.

C. Provide proper bearing on support framing of 2-inch minimum to steel and 4-inch minimum to CMU or concrete. Where shear connector studs are used, place deck so that the stud can be placed on top of the framing. If the stud falls within the top of the flute, cut a slot through the deck and provide closure so that fresh concrete will not leak.

D. Reinforce openings in accordance with structural framing details and manufacturer's recommended details.

E. Install strip closures at slab edges of the thickness of slab, as required to contain poured concrete. Ensure closures are of sufficient strength to remain in place without distortion.

F. Install closure strips and angle flashings as required to close openings between deck and walls, columns, and openings and gaps between deck, to prevent concrete leakage.

G. Connections: After deck has been aligned, provide permanent connections to the support framing with welds, shear connector studs, screw fasteners, or powder driven fasteners as required by the manufacturer or per plan. All closures, edge forms, plates, etc. shall be securely connected to the support framing per the manufacturers recommendations and per plan.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting work. Use welding washers where recommended by deck manufacturer.

I. Furnish shoring as required to maintain position of structures and prevent deflection beyond allowable limits. Ensure construction loads do not exceed deck carrying capacity per manufacturer.

J. Shear Connectors: Weld shear connectors to supports through decking units in accordance with manufacturer's instructions.

1. General: Shear studs may be used in lieu of 3/4-inch puddle welds. The studs shall be installed only by certified operators approved by the manufacturer and who are thoroughly familiar with the installation equipment. A copy of the operating instructions for the equipment shall be at the job site at all times. Interchanging of studs and welding equipment of different manufacturers is not permitted.

    a. Installation, inspection, and qualification of weld base metal shall conform to the requirements of AWS D1.1.
    b. The first two studs, at the start of each production period (the interval between start-up and shut-down of equipment) and at the start of each new welding procedure, shall be tested by bending to an angle of 30° by striking the stud with a hammer (in lieu of the first sentence in Paragraph a of the AWS code). If failure occurs in the weld, the procedure shall be corrected and the next two studs shall be welded and tested prior to welding of any more studs.
    c. If after welding, visual inspection reveals that a sound weld or a full 360° flash has not been obtained for a particular stud, the stud shall be replaced. At Contractor's option, the weld may be repaired by AWS D1.1.
    d. Studs that show no signs of failure shall be accepted as shear connectors provided they meet the dimensional limitations of the drawings, provided no portion is less than 1 inch from a proposed concrete surface, and provided any bends or out-of-plumbness does not exceed 15°. In addition, all studs shall extend not less than 1-1/2 inches above the top of the decking. If thru-deck stud welding is not practical, provide pre-punched holes in deck.

e. The studs shall have complete fusion to the steel beams underlying the decking. Where repairs are made by fillet welding, such welding shall be between stud and beam with removal of portions of the decking as required.
f. Ferrules shall be removed after completion.

2. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.
3. Space and align shear connectors as shown or, if not shown, as recommended by manufacturer.
4. On steel beam supporting steel deck with concrete or cast-in-place concrete, shear studs shall be placed at a maximum spacing of at 2'-0" on center.

K. Hanging Loads: Do not hang concentrated loads exceeding 50 pounds from metal roof deck. Loads shall be located no closer than 5'-0" from any adjacent hanging load.

L. Cleaning: Prior to placement of concrete or other finish materials, the deck shall be cleaned to be free of debris and water.

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Repair galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions at cut edges or locations where coating has been damaged.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

C. Provide protection against concrete splatter or spillage for all materials that would be adversely affected by this occurrence.

3.5 CONSTRUCTION LOADING

A. The Contractor shall assume complete responsibility for the loading of composite floor deck due to construction loads. The Contractor shall verify when it is acceptable to place loads on the composite floor deck with the deck supplier, who shall substantiate that the slab deck will not be damaged or have a reduced capacity as a result of the proposed construction loads.

B. The Contractor shall be responsible to repair any damage that occurs to the deck due to construction loads.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.
2. Interior load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Ceiling joist framing.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI).

B. American Society for Testing and Materials (ASTM).

C. International Building Code (IBC).

1.3 SUBMITTALS

A. Submit the following in accordance with Division 1 Section "Submittal Procedures."

B. Product Data: For each type of cold-formed metal framing product and accessory indicated.

C. Welding certificates.

D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Expansion anchors.
2. Powder-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

E. Research/Evaluation Reports: For cold-formed metal framing.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code-Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.

16. Southeastern Stud & Components, Inc.

17. Steel Construction Systems.

18. Steeler, Inc.

19. Super Stud Building Products, Inc.

20. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: All structural studs shall be 50 ksi steel.

2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).

B. Steel Sheet for Vertical Deflection: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by Structural Drawings.

2. Coating: G90 (Z275).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths as required, punched with stiffened flanges.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths as required, unpunched, with unstiffened flanges.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dietrich Metal Framing; a Worthington Industries Company.

b. MarinoWare, a division of Ware Industries.

c. SCAFCO Corporation

d. The Steel Network, Inc.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight 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, knee braces, and girts.

9. Joist hangers and end closures.

10. Hole reinforcing plates.

11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A1003, Structural Grade 50, Type H unless noted otherwise.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed metal 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 metal framing members by welding or screw fastening as indicated on Structural Drawings. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to 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 (1.6 mm).

D. Install cold-formed metal 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 metal framing members by welding or screw fastening. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, and complying 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 comparable in intensity 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 and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, in built-up exterior framing 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 standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Refer to Structural documents for installation information on load-bearing metal stud installation.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings, but not to exceed 16 inches (406 mm).

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, see structural drawings.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

F. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

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. Remove and replace work where test results indicate that it does not comply with specified requirements.

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 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide thermal and acoustic fiberglass batt insulation at all areas where existing exterior Gypsum sheathing is replaced.

B. Provide mineral wool batt and or blow-in mineral wool insulation at roof parapets, doghouse vents, and at areas requiring roof insulation replacement.

1.2 SUBMITTALS

A. Product Data: Published "R" value for thicknesses of insulation, product characteristics, performance criteria, and limitations.

B. Manufacturer's Instructions: Indicate installation requirements, special procedures, and information regarding conditions requiring special attention.

C. Warranty: Provide warranty as described below for inclusion into Operation and Maintenance Manuals in accordance with Division 01 Section Closeout Procedures.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver in manufacturer's original labeled package indicating R-value, thickness, and density.

B. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. Thermal Resistance Values: Comply with ASTM C 518. Thermal resistance values are shown on Drawings. Where not shown, comply with Energy Code for minimum R-Values.

B. Dimensional Stability: Linear shrinkage less than 0.1%.

2.2 MINERAL WOOL INSULATION

A. Product: ROCKWOOLGranulate Insulation for Blow-In Applications

1. R-Value: 3.0 to 3.3 per inch

B. Product: ROCKWOOL ComforTbatt for Wood Stud, unfaced Batt

1. R-Value: R-15, R-23, R-30
2. Density: > 2 lbs/ft2 (>32 kg/m³), nominal.
3. Surface Burning Characteristics: Tested in accordance with ASTM E84
   a. Unfaced: Flame Spread 0 and Smoke Developed 0
4. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.
5. Corrosion Resistance: Non-corrosive/Passed, when tested in accordance with ASTM C665 for Steel & ASTM C795 for Stress Corrosion Cracking Tendency of Austenitic Stainless Steel.
6. Fungi resistance: Zero mold growth to ASTM C1338

2.3 GLASS FIBER BATT INSULATION

A. Unfaced Batt Insulation: ASTM C 665, Type I.

1. Surface Burning Characteristics: ASTM E 84.
2. Flame spread: Maximum 25.
3. Smoke Developed: Maximum 50.
4. Combustion Characteristics: Passes ASTM E 136, non-combustible.
5. Insulation to be Formaldehyde-free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive Work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning Work constitutes acceptance of conditions as satisfactory.

B. Verify that substrate, adjacent materials are dry and ready to receive insulation.

3.2 INSTALLATION

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

B. Install insulation in all locations without gaps or voids and as indicated on Drawings.

C. Batt Insulation:

1. Do not compress insulation.
2. Completely fill small spaces leaving no uninsulated space and providing continuity of insulating layer. Install tightly around electrical outlets, switches, and other wall penetrations. Seal joints.

D. Exterior Walls - Thermal Insulation: Unfaced batt insulation. Friction fit between stud framing.

END OF SECTION

SECTION 07 24 19
DRAINABLE EXTERIOR INSULATION
FINISH SYSTEM (DEIFS)

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. This document is to be used in preparing specifications for a Drainable Exterior Insulation and Finish System (DEIFS) with Moisture Drainage including:
   a. An integral fluid applied air and water-resistive membrane barrier compatible with the substrate surface and adhesive application of the EIF system.
   b. Accessory materials required for treating sheathing joints, fasteners, penetrations, rough openings, and material transitions compatible with substrate surfaces and the adhesive application of the EIF system.
   c. Joint sealants compatible with specified DEIFS for use in all exterior envelope joint waterproofing.
   d. A comprehensive single source limited EIF system warranty inclusive of DEIFS, fluid applied air and water-resistive membrane barrier, accessory materials and sealants.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Construction Meetings

1. The DEIFS installer shall coordinate with the General Contractor to schedule, invite and administer a pre-construction meeting including but not limited to the architect of record, consultant(s), DEIFS, sheathing board, accessory materials and sealant manufacturer's representatives and the owner to assure required integration of products selected as specified herein and for proper sequencing and installation detailing.

B. Coordinate for related specification and integration of Selected Materials as referenced in Section 2.02.B.1, 2.02.B.2 and 2.02.C herein below.

C. Sequencing

1. Provide jobsite grading prior to installation of Exterior Insulation and Finish System with Moisture Drainage so that the system may be terminated at 8 in above grade or as required by code.

2. Coordinate installation of sheathing board and accessory materials, flashing, foundation waterproofing, roofing membrane, windows, doors, and other penetrations of the exterior walls to provide a continuous air and water-resistive membrane barrier.

3. Provide protection of rough openings before installing windows, doors, and other penetrations of the exterior walls.

4. Coordinate installation of windows and doors so air and water-resistive membrane barrier accessory materials, transitions, flashings, etc. are connected to them to provide a continuous barrier.

5. Install window and door head flashings immediately after windows and doors are installed.

6. Install diverter flashings wherever water can enter the wall assembly to direct water to the exterior.

7. Install copings and sealants immediately after installation of the Exterior Insulation and Finish System with Moisture Drainage and when DEIFS coatings are dry.

8. Attach penetrations through Exterior Insulation and Finish System to structural support and provide water-tight seals at penetrations.

1.04 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

A. Submit product data as required by Section 01 33 00, Administrative Requirements.

B. Submit shop drawings for panelized DEIFS with Moisture Drainage showing wall layout, connections, details, expansion joints, and installation sequence.

C. Submit two (2) samples of the Exterior Insulation and Finish System with Moisture Drainage for each finish, texture, and color to be used on the project. Use the same tools and techniques proposed for the actual installation. Make the samples of sufficient size to accurately represent each color and texture being utilized on the project.

D. Submit a current copy of the manufacturer's Trained Contractor Certificate for the EIF system specified. Submit Owner/Architect-requested test results verifying the performance of the Exterior Insulation and Finish System with Moisture Drainage.

E. Submit a copy of the manufacturer's installation details and application instructions.

1.05 CLOSEOUT SUBMITTALS

A. Submit a copy of the manufacturer's recommended maintenance and repair manual.

B. Submit a copy of the Exterior Insulation and Finish System with Moisture Drainage manufacturer's comprehensive single source limited warranty.

1.06 QUALITY ASSURANCE
(Note

A. Manufacturer's Qualifications:
   1. A member in good standing of the EIFS Industry Members Association (EIMA).

   2. Manufacture Exterior Insulation and Finish System with Moisture Drainage materials at a facility covered by a current ISO 9001:2015 and ISO 14001:2015 certification. Certification of the facility is done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).

B. Contractor Qualifications:

   1. Knowledgeable in the proper installation of the Exterior Insulation and Finish System with Moisture Drainage.

   2. Possess a current copy of the manufacturer's Trained Contractor Certificate for the EIF system specified.

   3. Successfully complete a minimum of three (3) projects of similar scope and scale to the specified project.

C Insulation Board Manufacturer Qualifications:

   1. Listed by EIFS Manufacturer, and capable of producing the Extruded Polystyrene (XPS) in accordance with the current EIFS Manufacturer's Specification for Insulation Board.

2. Subscribe to the Dryvit Third Party Certification and Quality Assurance Program.

D. Panel Fabricator Qualifications:

1. Experienced and competent in the fabrication of architectural wall panels.

2. Possess a current Outsulation X System Trained Contractor Certificate* issued by Dryvit Systems, Inc.

E. Panel Erector Qualifications:

1. Experienced and competent in the installation of architectural wall panel EIF systems.

2. Shall be:
   a. The panel fabricator or
   b. An erector approved by the panel fabricator or
   c. An erector under the direct supervision of the panel fabricator.

F. Mock-Up:

1. Provide the owner/architect with a mock-up for approval.
   a. Of suitable size as required to accurately represent the products being installed, as well as each color and texture to be utilized on the project.
   b. Prepared with the same products, tools, equipment and techniques required for the actual applications. Use finish from the same batch that is being used on the project.
   c. Available and maintained at the jobsite.

G. Regulatory Requirements:

1. Separate the XPS insulation board from the interior of the building by a minimum 15-minute thermal barrier.

2. Comply with local building codes for the use and maximum thickness of XPS insulation board.

H. Inspections:

1. Cooperate with independent, third-party inspectors when required by code or by contract documents.

1.07 DELIVERY, STORAGE AND HANDLING

1. Deliver all Exterior Insulation and Finish System with Moisture Drainage components and materials to the job site in the original, unopened packages with labels intact.

2. Inspect all Exterior Insulation and Finish System with Moisture Drainage components and materials upon arrival for physical damage, freezing or overheating. Do not use questionable materials.

3. Store all Exterior Insulation and Finish System with Moisture Drainage components and materials at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Maintain minimum and maximum storage temperature as stated in the product data sheets or specifications for the materials selected. **NOTE**: **Minimize exposure of materials to temperatures over 90 °F (32 °C). Finishes exposed to temperatures over the published maximum storage temperature for even short periods may exhibit skinning and increased viscosity and should be inspected prior to use.**

4. Protect all products from inclement weather and direct sunlight.

1.08 SITE CONDITIONS

A. Ambient Conditions

1. Do not apply wet materials during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.

2. Verify the minimum air and wall surface temperatures at the time of application as stated in the product data sheets or specifications for the materials selected.

3. Maintain these temperatures with adequate air ventilation and circulation for a minimum of 24 hours (48 hours for specific Specialty Finishes) thereafter, or until the products are completely dry.

(Note to Specifier: The use of dark colors must be considered in relation to wall surface temperature as a function of local climatic conditions. Use of dark colors in high temperature climates can affect the performance of the EIF system.)

1.09 WARRANTY

A. Manufacturers' Limited EIF System Warranty

1. Manufacturer shall offer a limited material defect and labor to repair or replace defective material warranty stating the Products will be free from manufacturing defect and will perform as warranted in the manner specified for the stated term measured from the Date of Project Substantial Completion.
   a. A pre-construction meeting, including representatives of the Manufacturer, the Applicator, the Owner, and the Consultant (if applicable), shall be required prior to installation of the Products.
   b. The term of this warranty may be extended for an additional *2* years with involvement on the project of a Manufacturer-approved, third-party consultant ("Consultant") engaged by the Owner or its authorized representative, at the Owner's sole expense. Inspection reports generated by the Consultant shall be made available to the Manufacturer and the Owner.
   c. The warranty is available upon written request.

2. The EIF system warranty shall additionally include the following for the term of the warranty or as specifically noted hereunder.

(Note to Specifier: An 18-year EIF system warranty is available when the Tremco ExoAir 230 Air and Water-Resistive Membrane Barrier and Dymonic 100 Accessory Material are selected as referenced in Section 2.02.B.1 and 2.02.B.2 below. Delete those AWRB's and Accessory Materials that do not apply. Amend warranty term below to 18-years.

   a. The EIF system warranty term shall be 18 years
   b. The DEIFS will remain in a watertight condition when the DEIFS is used in conjunction with approved Company Joinery and Sealants.
   c. The DEIFS will drain incidental moisture between the air/water-resistive barrier and the insulation board.
      1) Remedy includes repair or replacement of any sheathing or framing member that is damaged as a result of the EIF system failing to drain incidental moisture between the secondary weather barrier and the insulation board.
   d. Finish will be UV fade resistant for 10 years, except for specially produced colors.
      1) Specially produced colors will be UV fade resistant for 5 years when high-performance colorants are used to formulate.
   e. The DEIFS shall be eligible to receive a renewal of the original warranty if the Owner satisfactorily completes the specific renovation requirements published by the Manufacturer.

B. Installer Warranty

1. EIF system Installer shall provide a separate minimum 2-year warranty for all workmanship related to the proper installation and drainage performance of the DEIFS application. Manufacturer shall not be responsible for workmanship associated with the installation of Exterior Insulation and Finish System with Moisture Drainage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturers List:

1. Dryvit Systems, Inc., One Energy Way, West Warwick, RI 02893, 800-556-7752, www.dryvit.com.
2. Tremco, Inc., 3735 Green Road Beachwood, OH 44122 800.321.7906, www.tremco.com.

B. Substitution Limitations:

1. All components of the Outsulation® X System® including XPS Insulation Board shall be supplied or obtained from Dryvit Systems, Inc., Tremco, Inc. or their authorized distributors. Substitutions or additions of materials manufactured or supplied by others will void the EIF system warranty.

2. Alternate DEIFS manufacturers must demonstrate equivalency for all elements of EIF system such as but not limited to:
    a. Material components, compatibility and testing
    b. Standard and specialty finishes;
    c. Color and texture matching; and,
    d. Warranty criteria as specified herein.

3. Submit alternate DEIFS manufacturer's complete data highlighting equivalency for review through Substitution Requirements as defined in Division 01 25 13 Product Substitution Procedures (form included).

2.02 DESCRIPTION

A. System Description:

1. The Dryvit Outsulation X System is an Exterior Insulation and Finish System (DEIFS) with Moisture Drainage, consisting of:

    a. An Air and Water-Resistive Membrane Barrier
    b. Accessory Materials
    c. Adhesive – installed in vertical ribbons to facilitate egress of incidental moisture
    d. Extruded Polystyrene (XPS) insulation board
    e. Base Coat
    f. Reinforcing Mesh
    g. Finish Coat
    h. Joint Sealants as specified herein below

B. Materials:

1. Fluid-Applied Air and Water-Resistive Barrier (FAWRB):

    a. Permeable:
        1) Tremco ExoAir® 230: A thick film synthetic, permeable, elastomeric air/water-resistive membrane barrier designed to be roller or spray applied. ExoAir 230 can be installed in

ambient air and substrate surface temperatures of 40 °F (5 °C) and rising, shall be protected from rain and washout prior to drying and can be exposed for up to 12 months during the construction process. ExoAir is specialty formulated for design options requiring assembles that have been evaluated for NFPA 285.

2. Accessory Materials for Fluid Applied Air and Water-Resistive Barrier (AWRB):
   a. Provide compatible accessory materials as required by project conditions for substrate, rough opening and penetration preparation, bridge expansion joints in substrate, material transitions and flashing integration to produce a complete air and water-resistant assembly.
      1) Dryvit Grid Tape™: An open weave fiberglass mesh tape with pressure sensitive adhesive. Used in combination with Backstop NT or Backstop NTX Texture for treating sheathing board joints and inside / outside corners and preparing rough openings and penetrations. Backstop NT or Backstop NTX Texture is used alone for spotting fastener heads.
      2) Tremco Dymonic 100: A high-performance, high-movement, single-component, medium-modulus, low-VOC, UV-stable, non-sag, gun applied polyurethane sealant. Used in substrate preparation, treating sheathing board joints and inside/outside corners and fastener heads, preparing rough openings and penetrations, bridging expansion joints in substrate, material transitions and flashing integration. Dymonic 100 can be installed in ambient air and substrate surface temperatures of 40 °F (5 °C) and rising. Where Dymonic 100 must be applied in temperatures below 40 ˚F, (5 ˚C), please refer to the Tremco Technical Bulletin for Applying Sealants in Cold Conditions (No. S-08-44 rev 1) that can be found at www.tremcosealants.com.
      3) Tremco ExoAir 110AT: A 22-mil composite impermeable membrane that is comprised of 16 mils of butyl and 6 mills of HDPP facer. Used in limited applications as a membrane flashing that will not interfere with the adhesive application of DEIFS.

3. Drainage Components:

   a. Dryvit Drainage Strip™ corrugated plastic strip.
   b. Dryvit AP Adhesive™ urethane-based adhesive used to attach Drainage Track and Dryvit Drainage Strip to the sheathing.

4. Adhesives:

   a. Liquid polymer-based adhesive field mixed with Portland cement.
      1) Dryvit Genesis® – only

5. Insulation Board:

   a. Shall be Extruded Polystyrene (XPS) Rigid Insulation Board approved by Dryvit Systems, Inc.
   b. Minimum thickness shall be 1 in (25 mm) and maximum thickness shall be 4 in (102 mm)
   c. Install in board size of 2 ft x 4 ft (600 mm x 120 mm) maximum.
   d. All insulation board faces shall be factory planed.

6. Pre-Coated Insulation Starter Boards, Corners and Shapes:
   a. Machine Coated Starter Boards, Corners and Shapes: Shall be produced with materials approved by Dryvit Systems, Inc. and be supplied by a fabricator approved by Dryvit Systems, Inc.
   b. Non-Machine Coated Starter Boards, Corners and Shapes: Shall be produced with materials approved by Dryvit Systems, Inc.

7. Mechanical Fasteners:

   a. Mechanical Fasteners shall be required and installed into insulation board - 3 fasteners per 2 ft x 4 ft [600 mm x 1200 mm] – while the adhesive is still wet. Fasteners consist of a 2 in (51mm) diameter polypropylene washer with key openings for base coat penetration used in conjunction with a corrosion resistant fastener as outlined below.

1) Washer
   i. Shall be Wind-lock Wind Devil 2 Plate.
2) Screws
   i. Wood Based Substrates and Light Gauge Metal (20 – 26 ga).
      a) Shall be minimum No. 6, bugle head Type S, corrosion resistant screws.
      b) The screws shall be of sufficient length to penetrate wood substrates a minimum of 3/4 in (19 mm), and metal framing a minimum of 3/8 in (9 mm).
   ii. Steel Framing (12 – 20 ga)
      a) Shall be minimum No. 6 bugle head corrosion resistant screws, drill point.
      b) The screws shall be of sufficient length to penetrate the steel framing a minimum of 3/8 in (9 mm).
   iii. Brick, CMU and Concrete
      a) Anchors shall be a minimum 3/16 in (4.8 mm) diameter and corrosion resistant.
      b) Anchors shall be of sufficient length to penetrate the substrate a minimum of 1 in (25 mm).
3) Pullout values shall be substantiated for the particular substrate and fastener used.

8. Base Coat:

   a. Liquid polymer-based base coat field mixed with Portland cement.
      1) Dryvit Genesis - only
      2) Dryvit Dryflex - optional for high moisture areas. Coordinate use with Dryvit Systems, Inc.
9. Reinforcing Mesh:
   a. Open-weave, glass fiber fabric treated for compatibility with other EIF system materials.
   b. Standard Plus Mesh shall be required for all DEIFS field wall areas throughout. Additionally, incorporate as second layer over Dryvit Panzer Mesh for all Ultra High Impact Mesh Assemblies where indicated or shown on contract drawings.
   c. Provide for ultra high impact mesh assembly including**Panzer 15 mesh** for all DEIFS clad wall areas within 8'-0" of grade and where additionally indicated on contract drawings.

Reinforcing Mesh[1]/Weight oz/yd² (g/m²)	Minimum Tensile Strengths	EIMA Impact Classification	EIMA Impact Range in-lbs	(Joules)	Impact Test Results in-lbs	(Joules)
Standard - 4.3 (146)	150 lbs/in (27 g/cm)	Standard	25-49	(3-6)	36	(4)
Standard Plus - 6 (203)	200 lbs/in (36 g/cm)	Medium	50-89	(6-10)	56	(6)
Intermediate™ - 12 (407)	300 lbs/in (54 g/cm)	High	90-150	(10-17)	108	(12)
Panzer® 15[1] - 15 (509)	400 lbs/in (71 g/cm)	Ultra High	>150	(>17)	162	(18)
Panzer 20[1] - 20.5 (695)	550 lbs/in (98 g/cm)	Ultra High	>150	(>17)	352	(40)
Detail Mesh® Short Rolls - 4.3 (146)	150 lbs/in (27 g/cm)	n/a	n/a	n/a	n/a	n/a
Corner Mesh™ - 7.2 (244)	274 lbs/in (49 g/cm)	n/a	n/a	n/a	n/a	n/a
* It shall be colored blue and bear the Dryvit logo for product identification 1. Shall be used in conjunction with Standard Mesh (recommended for areas exposed to high traffic)						

10. Finish: Match existing as close as possible.

    a. Hydrophobic (HDP™) Finishes: 100% acrylic coating with integral color and texture and formulated with hydrophobic properties:
       1) Available textures:
          a) Sandblast® HDP

13. Coatings, Primers, and Sealants:
    a. Demandit® Smooth

C. Joint Sealants:
   a. Silicone Sealant: Tremco Spectrem 1: An ultra low modulus, high-performance, one-part, moisture-curing silicone joint sealant with physical properties making it an ideal sealant for sealing dynamic joints.

b. Tremco Spectrem 3: A general-purpose, low-modulus, high performance, one-part, neutral-cure, non-staining, low dirt pickup, construction-grade silicone sealant.
c. Tremco Spectrem 4-TS: A multi-component, neutral-curing, non-staining, low dirt pick up, low-modulus silicone sealant specially formulated for use in dynamically moving building joints. Spectrem 4-TS offers color flexibility with the opportunity to tint the material on site.
   a. Coordination for custom sealant colors are required.
d. Where deemed necessary, use of TREMprime Silicone Porous Primer.

D. Jobsite-Mixed Materials:

1. Portland cement: verify is Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.

2. Water: verify is clean and free of foreign matter.

E. Reference Documentation for Outsulation X System:
1. Data Sheet – DS932
2. Details – DS947
3. Application Instructions – DS937

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Verify access to electric power, clean water and a clean work area at the location where the Dryvit materials are to be applied.

2. Verify the deflection of the substrate does not exceed 1/240 times the span. Verify substrate is flat within 1/4 in (6.4 mm) in a 4 ft (1.2 m) radius.

3. Verify substrate is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the Exterior Insulation and Finish System with moisture drainage installation or performance.

4. Verify the slope of inclined surfaces are not less than 6:12 (27 °) were the length of the slope does not exceed 12 in (305 mm) or 3:12 (14 °) were the length of the slope does not exceed 4 in (102 mm).

5. Verify metal roof flashings have been installed in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards.

6. Verify all rough openings are flashed in accordance with the Exterior Insulation and Finish System with Moisture Drainage manufacturer’s installation details, or as otherwise necessary to prevent water penetration. Verify chimneys, balconies and decks have been properly flashed as necessary to prevent water penetration.

7. Verify windows and doors are installed and flashed per manufacturer's requirements and installation details.

8. Notify general contractor of all discrepancies prior to the installation of the Exterior Insulation and Finish System with moisture drainage.

9. Verify that expansion joints are installed:
   a. Where expansion joints occur in the substrate system.

b. Where building expansion joints occur.
c. At floor lines in wood frame construction.
d. At floor lines of non-wood framed buildings where significant movement is expected.
e. Where the Exterior Insulation and Finish System with moisture drainage abuts dissimilar materials.
f. Where the substrate type changes.
g. Where prefabricated panels abut one another.
h. In continuous elevations at intervals not exceeding 50 ft (15.2 m).
i. Where significant structural movement occurs, such as changes in roof line, building shape or structural system.

10. Vapor Retarders: The use and location of vapor retarders within a wall assembly is the responsibility of the project designer and shall comply with local building code requirements. The type and location shall be noted on the project drawings and specifications. Vapor retarders may be inappropriate in certain climates and can result in condensation within the wall assembly.

3.02 PREPARATION

A. Protect the Exterior Insulation and Finish System with Moisture Drainage materials by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.

B. Protect adjoining work and property during installation of the Exterior Insulation and Finish System with Moisture Drainage.

C. Prepare the substrate to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

3.03 INSTALLATION

A. Install the EIF system in accordance with ASTM C1397 and the Dryvit Outsulation X System Application Instructions, DS937. Apply base coat sufficient to fully embed the reinforcing mesh. The recommended method is to apply the base coat in two (2) passes.

B. Apply sealant to base coat surface prepared in accordance with DS153.

C. Install high impact reinforcing mesh as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage as designated on contract drawings.

D. Install Machine Coated Dryvit EPS Shapes in accordance with Dryvit Publication DS854.

3.04 SITE QUALITY CONTROL

A. Exterior Insulation and Finish System with Moisture Drainage manufacturer assumes no responsibility for on-site inspections or application of its products.

B. DEIFS sub-contractor to certify in writing the quality of work performed relative to the substrate system, details, installation procedures, and as to the specific products used.

C. XPS supplier, if requested, to certify in writing that the XPS meets the Exterior Insulation and Finish System with Moisture Drainage manufacturer's specifications.

D. The sealant contractor, if requested, to certify in writing that the sealant application is in accordance with the sealant manufacturers and the Exterior Insulation and Finish System with Moisture Drainage manufacturer's recommendations.

3.05 CLEANING

A. Remove all excess Exterior Insulation and Finish System materials from the job site by the contractor in accordance with contract provisions and as required by applicable law.

B. Leave all surrounding areas, where the Exterior Insulation and Finish System with Moisture Drainage has been applied, free of debris and foreign substances resulting from the DEIFS sub-contractor's work.

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Structural Metal Roof Panels: alternate to metal facias.

1.02 SUBMITTALS

A. Qualification Data: For Installer, design engineer.

B. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
   1. Summary of test results, indicating compliance with specified requirements.
   2. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Completed FM acceptance of roofing system worksheet(s): form immediately follows this section (Form X2688) as well as a Contractor’s Package from RoofNav for each roof area to FM Global for review and acceptance prior to installation.
   1. RoofNav can be accessed at www.RoofNav.com.

E. Sample: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.

F. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Data: For users operation and maintenance of system including:
   1. Methods for maintaining system's materials and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of roofing systems similar to those required for this project.
   1. Not less than 5 years of documented experience

2. Accredited by IAS according to IAS AC472.

B. Installer Qualifications: Company trained and authorized by roofing system manufacturer and specializing in performing the work of this section with minimum 5 years experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.

1.05 WARRANTY

A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant chalking, cracking, or peeling within specified warranty period of 20 year period from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Complete roofing assemblies, including factory formed panels with factory applied finish roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for conformance with performance criteria.

2.02 PERFORMANCE AND DESIGN CRITERIA

A. Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

B. Roof Covering External Fire-Resistance Classification: UL Class A.

C. Wind Uplift: Class 90 wind uplift resistance of UL 580.

D. Panels: Fabricate and finish panels and accessory items at factory, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

E. Joints: Factory-install captive gaskets, sealants, or separator strips at panel joints to provide weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.03 STRUCTURAL METAL ROOF PANELS

A. Basis of Design Product:
1. NuRay – NRM 7000

a. Thickness: 24 GA
b. Finish: Zincalume plus

2. Substitutions for products by manufacturers other than those listed above: See Section 01 25 13.

B. Performance Criteria:
1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed 1/180 of the span when tested in accordance with ASTM E1592.
a. Dead Loads: Weight of roofing system.
b. Snow Loads: As indicated on Drawings.
c. Live Loads: As required by ASCE 7.
2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
3. Water Penetration: No water penetration when tested according to procedures and recommended test pressures of ASTM E1646.

2.04 ACCESSORIES

A. All accessory materials required by the manufacturer for a warrantable installation of the installed products in a manner that meets the Performance and Design Criteria.

B. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels.

C. Miscellaneous Secondary Framing: Light gauge steel framing incidental to structural supports; fabricated from steel sheet.
1. Profile: Manufacturer's standard profile for conditions present.
2. Material: As required for material compatability with panel sheet material.

D. Attachment:
1. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

E. Miscellaneous Secondary Framing: Aluminum framing incidental to structural supports; fabricated from steel sheet.
1. Profile: Manufacturer's standard profile for conditions present.
2. Material: As required for material compatibility with panel sheet material.

F. Manufacturer's optional accessories required by the project:

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.02 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

B. Coordinate with installation of associated counterflashings and other components installed under other sections

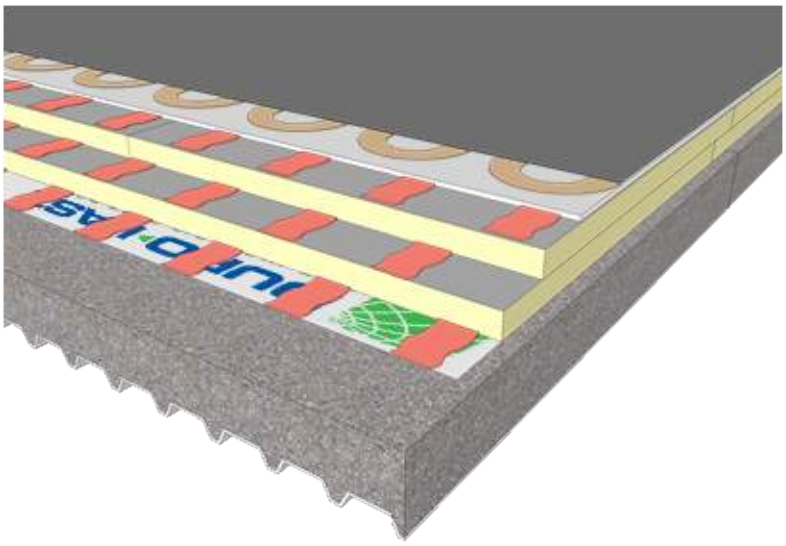
3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

DIVISION 07 54 19 –
POLYVINYL-CHLORIDE ROOFING



Roof Assembly Description

- **PVC thermoplastic membrane with fleece**
  Membrane Thickness: 60 mil nominal (78 mil including fleece)
  Color: Charcoal
  Attachment: Adhered with fleece membrane adhesive
- **Gypsum-fiber roof board**
  Thickness: ½ inch
  Attachment: Attached with insulation adhesive
  Conductive Primer: Coat entire cover board with conductive primer
- **Polyisocyanurate (tapered)**
  Attachment: Attached with insulation adhesive
- **Polyisocyanurate (flat)**
  Attachment: Attached with insulation adhesive
- **Vapor Barrier**
  Thickness: 31.5 mil
  Attachment: Loosely laid
- **Existing Poured Concrete Roof Deck**

PART 1 GENERAL

1.1 SECTION INCLUDES

A. PVC thermoplastic membrane with fleece adhered with fleece membrane adhesive.

B. Gypsum-fiber roof board, attached with insulation adhesive.

C. Polyisocyanurate (tapered), attached with insulation adhesive.

D. Polyisocyanurate (flat), attached with insulation adhesive.

E. Vapor Barrier loosely laid.

F. Prefabricated flashings, corners, parapets, stacks, vents, and related details.

G. Fasteners, adhesives, and other accessories required for a complete roofing installation.

H. Traffic Protection.

1.2 REFERENCES

A. NRCA - The NRCA Roofing and Waterproofing Manual.

B. ASCE 7 - Minimum Design Loads For Buildings And Other Structures.

C. UL - Roofing Materials and Systems Directory, Roofing Systems (TGFU.R10128).

D. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

E. ASTM D 751 - Standard Test Methods for Coated Fabrics.

F. ASTM D 4434 - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.

G. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.

H. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 SYSTEM DESCRIPTION

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Sustainability:

   a. Conform to NSF/ANSI Standard 347, “Sustainability Assessment for Single-Ply Roofing Membranes. Minimum certification level: Gold.

   b. Type III product-specific Environmental Product Declaration.

   c. Membrane is recyclable at end of use.

D. Physical Properties:

   1. Roof product must meet the requirements of Type III PVC sheet roofing as defined by ASTM D 4434 and must meet or exceed the following physical properties.

   2. Thickness: 60 mil (78 mil including fleece), nominal, in accordance with ASTM D 751.

   3. Thickness Over Scrim: ≥ 32 mil in accordance with ASTM D 751.

4. Breaking Strengths: ≥ 554 lbf. (MD) and ≥ 408 lbf. (XMD) in accordance with ASTM D 751, Grab Method.
5. Elongation at Break: ≥ 34% (MD) and ≥ 85% (XMD) in accordance with ASTM D 751, Grab Method.
6. Heat Aging in accordance with ASTM D 3045: 176 °F for 56 days. No sign of cracking, chipping or crazing. (In accordance with ASTM D 4434).
7. Factory Seam Strength: ≥ 322 lbf. in accordance with ASTM D 751, Grab Method.
8. Tearing Strength: ≥ 50 lbf. (MD) and ≥ 200 lbf. (XMD) in accordance with ASTM D 751, Procedure B.
9. Low Temperature Bend (Flexibility): Pass at -40 °F in accordance with ASTM D 2136.
10. Accelerated Weathering: No cracking, checking, crazing, erosion or chalking after 5,000 hours in accordance with ASTM G 154.
11. Linear Dimensional Change: ≤ 0.11% (MD) and 0.00% (XMD) in accordance with ASTM D 1204 at 176 ± 2 °F for 6 hours.
12. Water Absorption: ≤ 2.4% in accordance with ASTM D 570 at 158 °F for 166 hours.
13. Static Puncture Resistance: ≥ 33 lbs. in accordance with ASTM D 5602.
14. Dynamic Puncture Resistance: ≥ 14.7 ft-lbf. in accordance with ASTM D 5635.

E. Insulation

1. Provide overall thermal resistance for roofing system as follows:

a. Minimum R-value: 38.2.

2. Tapered Insulation Slope: 1/4 inch per foot.
3. Configuration as indicated on the Drawings.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

C. Sustainability Documentation:

a. NSF/ANSI Standard 347 Certificate.

b. Type III product-specific Environmental Product Declaration.

D. Shop Drawings: Indicate insulation pattern, overall membrane layout, field seam locations, joint or termination detail conditions, and location of fasteners.

E. Verification Samples: For each product specified, two samples, representing actual product, color, and finish.

1. 4 inch by 6 inch sample of roofing membrane, of color specified.
2. 4 inch by 6 inch sample of walkway pad.

3. Termination bar, fascia bar with cover, drip edge and gravel stop if to be used.
4. Each fastener type to be used for installing membrane, insulation/recover board, termination bar and edge details.

F. Installer Certification: Certification from the roofing system manufacturer that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

G. Manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with manufacturer's installation instructions.

B. Manufacturer Qualifications: A manufacturer specializing in the production of PVC membranes systems and utilizing a Quality Control Manual during the production of the membrane roofing system that has been approved by and is inspected by Underwriters Laboratories.

C. Installer Qualifications: Company specializing in installation of roofing systems similar to those specified in this project and approved by the roofing system manufacturer.

D. Source Limitations: Obtain components for membrane roofing system from roofing membrane manufacturer.

E. There shall be no deviations from the roof membrane manufacturer's specifications or the approved shop drawings without the prior written approval of the manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for roof assembly wind uplift and fire hazard requirements.

B. Fire Exposure: Provide membrane roofing materials with the following fire-test-response characteristics. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure:
    a. Class A; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: Comply with ASTM E 119 for fire-resistance-rated roof assemblies of which roofing system is a part.
3. Conform to applicable code for roof assembly fire hazard requirements.

C. Conform to IECC (International Energy Conservation Code) and IGCC (International Green Construction Code) cool roof requirements.

D. Wind Uplift:

1. Roofing System Design: Provide a roofing system designed to resist uplift pressures calculated according to the current edition of the ASCE-7 Specification *Minimum Design Loads for Buildings And Other Structures*.

1.7 PRE-INSTALLATION MEETING

A. Convene meeting not less than one week before starting work of this section.

B. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review structural loading limitations of roof deck during and after roofing.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
6. Review governing regulations and requirements for insurance and certificates if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

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, 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.

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. Store roof materials and place equipment in a manner to avoid permanent deflection of deck.

E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 WARRANTY

A. Contractor's Warranty: The contractor shall warrant the roof application with respect to workmanship and proper application for two (2) years from the effective date of the warranty issued by the manufacturer.

B. Manufacturer's Warranty: Must be no-dollar limit type and provide for completion of repairs, replacement of membrane or total replacement of the roofing system at the then-current material and labor prices throughout the life of the warranty. In addition, the warranty must meet the following criteria:

1. Warranty Period: 30 years from date issued by the manufacturer. Full warranty requirements can be found at https://portal.duro-last.com/warranty-requirements
2. Must provide positive drainage (no ponding water).
3. No exclusion for damage caused by biological growth.
4. Issued direct from and serviced by the roof membrane manufacturer.
5. Transferable for the full term of the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. All roofing system components to be provided or approved by roof system manufacturer.

B. Acceptable Manufacturers:

1. Duro-Last, Inc.
2. Sika-Sarnafil
3. FiberTite

2.2 ROOFING SYSTEM COMPONENTS

A. Roofing Membrane: PVC thermoplastic membrane with fleece conforming to ASTM D 4434, type III, fabric-reinforced, PVC. Membrane properties as follows:

1. Thickness:
    a. 60 mil nominal (78 mil including fleece).
2. Exposed Face Color:
    a. Charcoal.

B. Minimum NSF 347 Gold certified.

C. Accessory Materials: Provide accessory materials supplied by or approved for use by roof system manufacturer

1. Sheet Flashing: Manufacturer's standard reinforced PVC sheet flashing.
2. Factory Prefabricated Flashings: manufactured using Manufacturer's standard reinforced PVC membrane.
    a. Stack Flashings.
    b. Curb Flashings.
    c. Inside and Outside Corners.
    d. Drain Boots, Composite Drain Rings (CDR) and Dome Strainers.
    e. Membrane Scupper Liners.
    f. Vinyl Coated Pitch Pans.
3. Sealants and Adhesives: Compatible with roofing system and supplied by roof system manufacturer.
    a. Fleece Membrane Adhesive.
    b. Low-Rise Foam Insulation Adhesive.
    c. Caulk.
    d. Strip Mastic.
4. Slip Sheet: Compatible with roofing system and supplied by roof system manufacturer.
5. Fasteners and Plates: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane and insulation to substrate. Supplied by roof system manufacturer.
6. PV Anchors
7. Termination and Edge Details: Supplied by roof system manufacturer.
    a. Termination Bar.

b. Universal 2-Piece Edge Metal System.

c. AllTerm™.

d. Vinyl Coated Metal Drip Edge with Factory Attached Membrane Skirt.

e. Edge Metal Fascia System.

f. Flat Coping.

g. Snap Coping.

h. Canted Coping.

i. Fascia Base with Kynar Steel Cover.

j. Vinyl Fascia Bar.

k. Vinyl Fascia Cover.

l. Vinyl Gravel Stop.

m. Vinyl Drip Edge.

8. Vinyl Coated Metal: 24 gauge, hot-dipped galvanized, grade 90 metal with a minimum of 17 mil of PVC roofing membrane laminated to one side.

D. Conductive Primer placed on top of Cover Board: Detec TruGround

E. Slip Sheet:

1. Vapor Barrier.

F. Walkways:

1. Provide non-skid, maintenance-free walkway pads from door and to all mechanical equipment.

a. Walkway Pad.

2.3 ROOF INSULATION

A. General:

1. Provide preformed roof insulation boards that comply with requirements and referenced standards, as selected from manufacturer's standard sizes.

2. Provide preformed saddles, crickets, and other insulation shapes, where indicated, for sloping to drain. Fabricate to slopes indicated.

B. Polyisocyanurate Board Insulation: Complying with ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces. Material as supplied by roof system manufacturer.

1. Polyisocyanurate (flat).

2. Polyisocyanurate (tapered).

2.4 ROOF INSULATION ACCESSORIES

A. General: Provide roof insulation accessories approved by the roof membrane manufacturer and as recommended by insulation manufacturer for the intended use.

B. Insulation Adhesive: Provide insulation adhesive for attaching insulation and/or insulation cover boards in conformance to specified design requirements.

C. Cover Board:

1. ½ inch thick SECUROCK® Gypsum-Fiber Roof Board as manufactured by United States Gypsum Company.

2. Note: Cover Board shall be coated with Conductive Primer prior to application of fully adhered roof membrane.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the surfaces and site conditions are ready to receive work.

B. Verify that the deck is supported and secured.

C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.

D. Verify that the deck surfaces are dry and free of standing water, ice or snow.

E. Verify that all roof openings or penetrations through the roof are solidly set.

F. If substrate preparation is the responsibility of another contractor, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Surfaces shall be clean, smooth, free of fins, sharp edges, loose and foreign material, oil, grease, and bitumen.

3.3 INSTALLATION

A. Install insulation in accordance with the roof manufacturer's requirements.

B. Separation Slip Sheet: Vapor Barrier.
   1. Install in accordance with the roof manufacturer’s requirements.

C. Insulation: Polyisocyanurate (flat) and Polyisocyanurate (tapered).
   1. Install insulation in accordance with the roof manufacturer’s requirements.
   2. Insulation shall be adequately supported to sustain normal foot traffic without damage.
   3. Where field trimmed, insulation shall be fitted tightly around roof protrusions with no gaps greater than ¼ inch.
   4. Tapered insulation boards shall be installed in accordance with the insulation manufacture’s shop drawings.
   5. No more insulation shall be applied than can be covered with the roof membrane by the end of the day or the onset of inclement weather.
   6. If more than one layer of insulation is used, all joints between subsequent layers shall be offset by at least 6 inches.

D. Insulation Cover Board: Gypsum-fiber roof board.

E. Roof Membrane: 60 mil nominal (78 mil including fleece), PVC thermoplastic membrane with fleece.

F. Seaming:
   1. Weld overlapping sheets together using hot air. Minimum weld width is 1-1/2 inches.
   2. Check field welded seams for continuity and integrity and repair all imperfections by the end

of each work day.

G. Membrane Termination/Securement: All membrane terminations shall be completed in accordance with the membrane manufacturer's requirements.

1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
2. Provide securement at any angle change where the slope or combined slopes exceeds two inches in one horizontal foot.

H. Flashings: Complete all flashings and terminations as indicated on the drawings and in accordance with the membrane manufacturer's requirements.

1. Provide securement at all membrane terminations at the perimeter of each roof level, roof section, curb flashing, skylight, expansion joint, interior wall, penthouse, and other similar condition.
   a. Do not apply flashing over existing thru-wall flashings or weep holes.
   b. Secure flashing on a vertical surface before the seam between the flashing and the main roof sheet is completed.
   c. Extend flashing membrane a minimum of 6 inches (152 mm) onto the main roof sheet beyond the mechanical securement.
   d. Use care to ensure that the flashing does not bridge locations where there is a change in direction (e.g. where the parapet meets the roof deck).
2. Penetrations:
   a. Flash all pipes, supports, soil stacks, cold vents, and other penetrations passing through the roofing membrane as indicated on the Drawings and in accordance with the membrane manufacturer's requirements.
   b. Utilize custom prefabricated flashings supplied by the membrane manufacturer.
   c. Existing Flashings: Remove when necessary to allow new flashing to terminate directly to the penetration.
3. Pipe Clusters and Unusual Shapes:
   a. Clusters of pipes or other penetrations which cannot be sealed with prefabricated membrane flashings shall be sealed by surrounding them with a prefabricated vinyl-coated metal pitch pan and sealant supplied by the membrane manufacturer.
   b. Vinyl-coated metal pitch pans shall be installed, flashed and filled with sealant in accordance with the membrane manufacturer's requirements.
   c. Pitch pans shall not be used where prefabricated or field fabricated flashings are possible.

I. Roof Drains:

1. Coordinate installation of roof drains per drawings and relevant plumbing specifications.
2. Remove existing flashing and asphalt at existing drains in preparation for sealant and membrane.
3. Provide a smooth clean surface on the mating surface between the clamping ring and the drain base.

J. Edge Details:

1. Provide edge details as indicated on the Drawings. Install in accordance with the membrane manufacturer's requirements.

2. Join individual sections in accordance with the membrane manufacturer's requirements.
3. Coordinate installation of metal flashing and counter flashing specified in Section 07620.
4. Manufactured Roof Specialties: Coordinate installation of copings, counter flashing systems, gutters, downspouts, and roof expansion assemblies specified in Section 07710.

K. Walkways:

1. Install walkways in accordance with the membrane manufacturer's requirements.
2. Provide walkways where indicated on the Drawings.
3. Install walkway pads at roof hatches, access doors, rooftop ladders and all other traffic concentration points regardless of traffic frequency. Provided in areas receiving regular traffic to service rooftop units or where a passageway over the surface is required.
4. Do not install walkways over flashings or field seams until manufacturer's warranty inspection has been completed.

L. Water cut-offs:

1. Provide water cut-offs daily at the completion of work and at the onset of inclement weather.
2. Provide water cut-offs to ensure that water does not flow beneath the completed sections of the new roofing system.
3. Remove water cut-offs prior to the resumption of work.
4. The integrity of the water cut-off is the sole responsibility of the roofing contractor.
5. Any membrane contaminated by the cut-off material shall be cleaned or removed.

3.4 FIELD QUALITY CONTROL

A. The membrane manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors shall be addressed, and final punch list completed.

B. Electronic Leak Detection (ELD): Contractor shall have the membrane tested with ELD. Reports shall be provided to Owner and Architect

3.5 PROTECTION

A. Protect installed roofing products from construction operations until completion of project.

B. Where traffic is anticipated over completed roofing membrane, protect from damage using durable materials that are compatible with membrane.

C. Repair or replace damaged products after work is completed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed wall sheet metal fabrications.

2. Scuppers and Downspouts

3. Other sheet metal as indicated.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

1. Identification of material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.

4. Details of termination points and assemblies, including fixed points.

5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.

6. Details of perimeter conditions.

7. Details of specialized conditions including saddles, transitions and terminations in sheet metal flashing.

8. Details of connections to adjoining work.

9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

C. Samples: for Initial Selection: For each type of sheet metal flashing and accessory indicated with factory-applied color finishes involving color selection.

1. 6” square samples of specified sheet metal materials to be exposed as finished surfaces.

2. 12” long samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.

3. One 11 oz. tube of each specified sealant.

4. Two samples each of proposed fasteners and accessories to be used.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

2. Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

3. Accessories and Miscellaneous Materials: Full-size Sample.

E. Qualification Statements: For qualified fabricator.

F. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing similar to that required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless A/E specifically approves such deviations in writing.

2. Build mockup of each fabrication, including saddles, coping, reglet and counterflashing, approximately 10 feet (3.0 m) long, including inside corners, outside corners, supporting construction cleats, seams, attachments, underlayment, and accessories.

3. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by A/E.

4. Notify the Owner and the A/E one week in advance of the dates and times when mockups will be constructed.

5. Demonstrate the proposed range of aesthetic effects and workmanship.

6. Obtain A/E's approval of mockups before start of final unit of Work.

7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. General: Sheet metal flashing assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Completed sheet metal flashing shall not rattle, leak, or loosen, and shall remain watertight.

B. Install systems to allow movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subjected to 100-year seasonal temperature ranges.

C. Thermal Movements: Provide sheet metal flashing that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

D. Install specialized, custom fabricated, sheet metal saddles for waterproof performance at terminations and transitions of sheet metal flashing and trim such as multi-plane intersects, and:

1. Where indicated.

2. Where constructed conditions will not provide watertight performance without saddles.

E. Install specialized, custom fabricated, sheet metal saddles for waterproof performance at terminations and transitions of construction components such as multi-plane intersects, and:

1. Where indicated.

2. Where constructed conditions will not provide watertight performance without saddles.

F. Contractor shall inspect transitions and terminations to make Project watertight. Contract Documents indicate design intent and may not indicate all instances where saddles apply. Field verify locations where saddles are required.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; 2D (dull, cold rolled) finish.

1. Locations: For use over steel lintels and other locations as indicated on drawings.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

C. Concealed Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

1. Subject to compliance with requirements, provide ADCO GT-106; ADCO or approved equal.

2. Provide pre-shimmed butyl sealant tape between sheet metal laps, at concealed locations, and where indicated.

D. Exposed Sealants: Elastomeric Sealant ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

1. Refer to Section 07 92 00 – Joint Sealants.

E. Concealed Sealant: ASTM C 1311, single-component, non-curing, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

1. Subject to compliance with requirements, provide ADCO BP-300; ADCO or approved equal.

2. Provide butyl sealant between sheet metal laps, at concealed locations, and where indicated.

F. Sealing Washers: Stainless steel backed EPDM washers.

2.4 FASTENERS

A. Annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

B. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

1. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.

2. Blind Fasteners: High-strength stainless-steel rivets suitable for metal being fastened.

C. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Type 304 stainless steel.

1. Provide Type 304 stainless steel fasteners where fastening through pressure treated wood.

D. Fasteners for Zinc-Coated (Galvanized) Steel Sheet Metal to Zinc-Coated (Galvanized) Steel Sheet Metal Components: No.10, hot-dip galvanized sheet metal screws equipped with sealing washers.

E. Fasteners for Stainless Steel Sheet: Type 304 stainless steel.

F. Fasteners for Stainless-Steel Sheet Metal to Stainless-Steel Sheet Metal Components: No.10, stainless steel sheet metal screws equipped with sealing washers.

G. Drive Pin Anchors: Subject to compliance with requirements provide Zamac Nailin; Powers Fasteners or approved equal.

1. Body: Zamac alloy, mushroom.

2. Pin: Type 304 stainless steel.

H. Fastener Sizes: Use fasteners of sizes that will penetrate wood substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Sheet metal components requiring fabrication must have shop drawings submitted and approved prior to fabrication and delivery to the project site. Materials delivered to the project site without the required A/E’s approval shall be immediately removed from the site and not incorporated into the completed Work.

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. Obtain field measurements for accurate fit before shop fabrication.

4. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

6. Field verify dimensions prior to fabrication.

7. Solder sheet metal prior to application of finish.

8. Flashings shall have minimum 4 inch vertical back leg and 2 inch overlap at exposed side.

B. Materials delivered to the project site without the required A/E’s approval shall be immediately removed from the site and shall not be incorporated into the completed Work.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to specified tolerance.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Pop rivet pieces together at 1 inch on center prior to soldering. Tin edges to be seamed, form seams, and solder. Sweat solder the lap. Solder rivet holes watertight.

H. Coil-Coated Seams: Fabricate nonmoving seams with flat-lock seams. Lap seams 4 inches and seal in a full bed of butyl sealant. Apply butyl sealant so it does not ooze out of seam. Rivet joints at 1 inch on center. Apply polyurethane sealant over rivets.

I. Form pieces to a minimum length of 8 feet with the exception of pieces with a total length of less than 8 feet.

J. Form pieces to maximum length of 10 feet.

K. Corners: Sheet metal corner flashing shall be fully soldered to form one watertight piece.

L. Hem exposed edges on underside 1/2 inch.

M. Fabricate head flashing, sill flashing and similar with end dams soldered/welded watertight.

N. Provide drip edges where indicated on the Contract Drawings.

O. Provide 4 inch minimum wide horizontal flanges, where dimension is not indicated on Contract Drawings.

2.6 WALL SHEET METAL FABRICATIONS

A. Fabricate wall sheet metal flashings with minimum 4 inch vertical leg.

1. .

B. Drip Edge Flashing at Steel Angle: Fabricate from the following materials:

1. Stainless Steel: 24 gauge.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

4. Provide end dams at end of each length of shelf angle; align in cast stone head joints.

5. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

6. Install sealant tape where indicated.

7. Torch cutting of sheet metal flashing and trim is not permitted.

B. Install all metal flashing and sheet metal in accordance with the recommendations of:

1. SMACNA Architectural Sheet Metal Manual.

2. NRCA Roofing and Waterproofing Manual.

C. The requirements of this Section supersede the above noted references except where the requirements of the reference specification are more stringent.

D. Do not fabricate or install any sheet metal item without the A/E's written approval.

E. Lap joints in direction of water flow.

F. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces. Carefully clean and dispose of cuttings so not to damage adjacent materials. Repair or replace damaged materials at no additional cost to the Owner.

G. Use concealed fasteners except where specifically approved by the A/E. Provide expansion joints concealed within system.

H. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Where installing metal flashing directly on cementitious or wood substrates, install a course of high temperature self-adhering flashing.

I. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

J. Solder or seal all seams and end joints as shown in the Drawings or required by field conditions. Measure all dimensions in the field necessary to properly fabricate the flashings. Fit flashings tight in place, however, allow for 3/4 inch minimum clearance to install components. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

K. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant.

2. Form joints to completely conceal sealant.

3. When ambient temperature at time of installation is moderate, between 40 and 70 degrees F, set joint members for 50 percent movement each way.

4. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F.

5. Lap sheet metal flashing and trim 4 inches in a full bed of sealant. Sealant shall be fully concealed. Remove visible sealant.

6. Rivet sealed laps at 1 inch on center.

7. Apply sealant over rivets.

8. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

9. Install compatible sealants where required to prevent direct weather penetration.

L. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder coil-coated or membrane-clad sheet metal.

2. Neatly solder all sheet metal to be soldered.

3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

5. All flat lock seams and lap seams, where soldered, shall be at least 1/2 inch. Pop rivet pieces together 1 inch on center prior to soldering. Sweat solder under the lap. Do not bead solder. Solder rivet holes to be water tight.

6. Thoroughly wash all flux off work after soldering. Failure to do this may result in back charges as a result of damages to finishes.

M. Rivets: Rivet joints where indicated and where necessary for strength at 1 inch on center, unless otherwise indicated. Apply sealant over rivets.

N. Paint metal where indicated in strict accordance with manufacturer’s written instructions, including minimum dry mil thicknesses.

3.3 WALL SHEET METAL INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Saddles, Transitions, and Terminations: Coordinate installation of saddles, transitions, and terminations with installation of siding, self-adhering sheet waterproofing, weather resistive barrier, and other components of the construction.

1. Miscellaneous flashing not installed in accordance with the Contract Documents will require the removal and reinstallation of construction to properly install the required flashing at no additional cost to the Owner.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Penetration firestopping.

B. Fire resistive joint systems.

1.02 RELATED REQUIREMENTS

A. 09 29 00 - Gypsum Board Assemblies: for fire rated assemblies requiring firestopping.

B. Divisions 21-26: for items typically penetrating fire rated assemblies requiring firestopping.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section,
1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.04 SUBMITTALS

A. Qualification Data: For manufacturer, and installer.

B. Product Data: Provide product criteria, characteristics, accessories, and jointing methods, and termination conditions.

C. Shop Drawings: Indicate system design listing by UL, FM Research, Intertek Testing Services, Omega Point Laboratories (OPL).
1. Where system design listing is not available for a particular configuration provide an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal

D. Contractor Installation log.

E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

F. Maintenance Data: For users’ operation and maintenance of system including:
1. Methods for maintaining system's materials.

1.05 QUALITY ASSURANCE

A. Manufacturer of firestop products shall have been successfully producing and supplying these products for a period of not less than 3 years, and be able to show evidence of at least 10 projects where similar products have been installed and accepted.

B. Fabricators Qualifications: Company specializing in performing the work of this section with minimum 5 years experience on projects of similar size and complexity.

C. Installer Qualifications:
   1. FM Approved in accordance with FM Standard 4991 - Approval of Firestop Contractors.
   2. UL Qualified Firestop Contractor.

1.06 MOCK-UP

A. Prior to installing firestopping, erect mockups for each different firestop system indicated to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.
   1. Locate mockups on site in locations indicated or, if not indicated, as directed by Owner.
   2. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

1.07 WARRANTY

A. Installation Warranty: Contractor shall correct defective Work within a five year period after Date of Substantial Completion.

B. Manufacturer Warranty: Provide five year warranty for firestopping systems.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Systems designed to maintain fire rating of assemblies around edges and penetrations.

2.02 PERFORMANCE AND DESIGN CRITERIA

A. Penetrations: Provide firestopping systems that resist the spread of fire, and the passage of smoke and other gases according to requirements indicated:
   1. Firestop all penetrations passing through fire resistance rated wall and floor assemblies and other locations as indicated on the drawings.

2. Provide complete penetration firestopping systems that have been tested and approved by third party testing agency.
3. F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than one hour or the fire-resistance rating of the construction being penetrated.
4. T - Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated by Code.
5. Provide T-Rating Collar Devices tested in accordance with ASTM E-814 or ANSI/UL1479 for metallic pipe penetrations requiring T-Ratings per the applicable building code.
6. L - Rated Through-Penetration Firestop Systems: Provide firestop systems with L ratings, in addition to F and T ratings, as determined per UL 1479, where indicated by Code.
7. W - Rated Through-Penetration Firestop Systems: Provide firestop systems with W Water Resistance ratings, in addition to F, T and L ratings, as determined per UL 1479, where indicated.

B. Perimeter Fire Containment Systems: Provide interior perimeter joint systems with fire-resistance ratings indicated, as determined per ASTM E 2307, but not less than the fire-resistance rating of the floor construction.

C. Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, as determined per UL 2079, but not less than the fire-resistance rating of the construction in which the joint occurs.

D. For firestopping exposed to view, traffic, moisture, and physical damage, provide appropriate firestop systems for these conditions.
   1. Exposed to view firestopping must be paintable.

E. Firestop material must be able to be installed per manufacturers written instructions in temperatures ranging from 35 degrees F to 120 degrees F, and have the ability to be frozen, thawed and still comply with its UL designation and testing results.

F. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.

G. Movement:
   1. Provide firestop sealants and fire resistive joint sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
   2. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM E-1399, ASTM E-1966 or ANSI/ UL 2079.

H. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.

I. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.

J. When mechanical cable pathways are not practical, openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.

K. Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall. Systems within the UL Fire Resistance Directory that meet this criterion are identified with the words “Chase Wall Optional”.

L. Provide penetration firestop systems, fire-resistive joint systems, or perimeter fire barrier systems subjected to an air leakage test conducted in accordance with Standard, ANSI/ UL1479 for penetrations and ANSI/UL2079 for joint systems with published L-Ratings for ambient and elevated temperatures as evidence of the ability of firestop system to restrict the movement of smoke.

2.03 MANUFACTURERS

A. Specification is based on products listed in assemblies shown on Drawings.
   1. Comparable products by one of the following are also acceptable. See Section 016000 - Product Requirements for submittal requirements.
      a. 3M Fire Protection Products
      b. HILTI, Inc.
      c. Hydroflame.
      d. Specified Technologies, Inc.
   2. Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping..

3.02 PREPARATION

A. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond. Do not allow spillage and migration onto exposed surfaces.

B. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed. Remove tape as soon as it is possible to do so without disturbing the firestopping seal with substrates.

C. Verify that system components are clean, dry, and ready for installation.

D. Verify that field dimensions are as shown on the Drawings and as recommended by the manufacturer.

3.03 PENETRATION FIRESTOP INSTALLATION

A. Ensure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed prior to installation of firestop assemblies.

B. Ensure that partitions and all other construction that conceal penetrations are not erected prior to the installation of firestop and smoke seals.

C. Install forming/damming materials and other accessories in accordance with manufacturers written instructions.

D. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
   1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
   2. Install materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed finish to produce smooth, uniform surfaces.

3.04 FIRESTOP JOINT SYSTEM INSTALLATION

A. Install joint fillers to provide support of firestop materials during application

B. Provide at the position to produce the cross-sectional shapes and depths of installed firestop material relative to joint widths for optimum sealant movement capability and required fire-resistance.

C. Install systems that result in firestop materials:
   1. Directly contacting and fully wetting joint substrates.
   2. Completely filling recesses provided for each joint configuration.
   3. Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.

D. Tool non-sag firestop materials immediately after pplication and prior to skinning begins. Form smooth, uniform beads of configuration indicated or required to:
   1. Produce fire-resistance rating.
   2. Eliminate air pockets.

3. Ensure contact and adhesion with sides of joint.

3.05 INSTALLATION LOG

A. Include the following items for all firestop and fire resistive joint installations:
   1. Contractor's name, address, and phone number.
   2. Through-penetration firestop systems designation of applicable testing and inspecting agency.
   3. Date of installation.
   4. Firestop systems manufacturer's name.

B. Provide as a pdf file with bi-directional links to floor plans and elevations to clearly illustrate location of material.

3.06 IDENTIFICATION

A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems.

3.07 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses. Use methods and cleaning materials approved by manufacturers of firestopping products and or assemblies in which openings and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Joint sealants

2. Reference also 07 24 19 “DEIFS” and 07 54 80 PVC Roofing for specialty sealants required for warranties per product Basis of Designs.

1.02 SUBMITTALS

A. Product Data: For each joint-sealant product.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in Work of this Section with minimum five (5) years continuous documented experience for commercial quality sealant Work comparable to Project scope.

B. Manufacturer: Make tests determining compatibility of exterior silicone sealants with substrates as necessary to conform to manufacturer's Warranty provisions.

C. Mock-ups: Build mock-ups incorporating sealant joints, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Manufacturer must perform adhesion and/or pull testing on mock-up sealants before final installation.

D. Pre-Installation Conference: Arrange a pre-installation conference, in accordance with Division 01 Section Project Meetings, between Contractor, subcontractor, Owner, Architect, manufacturer's representative, and any other concerned party two (2) weeks prior to beginning Work of this Section.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

B. Contractor is required to select a single source manufacturer for joint sealant applications.

2.02 JOINT SEALANTS

A. Sealants at DEIFS, Louvers and Window Frames Perimeters: One component, neutral cure, 100 percent silicone polymer sealant.

1. Acceptable Products:

a. GE SCS2000 manufactured by Momentive

b. Pecora 890FTS manufactured by Pecora

c. Dow 790 or 795 manufactured by Dow Corning

d. Tremco Spectrem 1 or 3 manufactured by Tremco

2.03 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, 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.

2.04 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 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 laitance and form-release agents from concrete.

2. 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.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.02 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. 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.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Non fire rated steel doors.

B. Fire rated steel doors.

C. Interior smoke and draft control doors.

D. Non fire rated steel frames.

E. Fire rated steel frames.

F. Exterior steel frames.

1.02 RELATED REQUIREMENTS

A. 08 71 00 - Door Hardware: for hardware installed in hollow metal doors

B. 08 80 00 - Glazing: for glass in doors and borrowed lites.

C. 09 90 00 - Painting and Coating: for field painting.

1.03 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes. Include U-value data for thermally broken doors and frames.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

C. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Data: For users operation and maintenance of system including:
   1. Methods for maintaining system's materials and finishes.

2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.

1.06 WARRANTY

A. Installation Warranty: Contractor shall correct defective Work within a 2 year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Specification is based on Doors and Frames by Assa Abloy Ceco, Curries, MESKER a dormakaba Brand. or Fleming: www.assaabloydss.com.
1. Comparable products by one of the following are also acceptable.
a. Steelcraft, Allegion brand; www.allegion.com
2. Substitutions for products by manufacturers other than those listed above: See Section 01 25 13- Product Substitutions.

2.02 DESCRIPTION

A. Hollow metal frames for hollow metal doors, wood doors and glazing. Hollow metal doors for fire rated, non-fire rated, sound rated, and bullet resistant and insulated openings.

2.03 PERFORMANCE AND DESIGN CRITERIA

A. Comply with ANSI/ICC A117.1. Accessibility Code.

B. Comply with ANSI A250.8 in general and for grade and style specified.

C. NAAMM HMMA doors of equivalent or better construction are allowed.

D. Provide hardware preparation in accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard. Coordinate with Section 087100 - Door Hardware.

E. Product Contents: Provide products that do not contain any components listed in Section 016119 - Chemicals of Concern Restrictions.

2.04 MATERIALS

A. Non-fire-rated steel doors.
   1. Performance Criteria:
      a. Grade: ANSI A250.8 Level 3, physical performance Level C, Model 2, seamless.
      b. Thickness: 1-3/4 inches.
      c. Interior Doors, Non-Fire-Rated:
      d. Exterior Doors, Non-Fire-Rated:
         1) Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
         2) Insulating Value: U-value of 0.30, when tested in accordance with ASTM C1363.
   2. Features:
      a. Door Top and Closures: Steel, Flush with top of faces and edges.
      b. Door Edge Profile: Beveled on both edges.
      c. Face Texture: Smooth.
      d. Glazed Lights: Sizes and configurations as indicated on drawings. Provide secure glazing stops on secure side of door.
         1) Glazing: Fully Tempered Float Glass specified in Section 088000 - Glazing.
      e. Finish: Factory primed for field finishing.
      f. Field Finish: In accordance with Section 099000 - Painting and Coating.
      g. Field Finish Color: To be selected by Architect from manufacturer's full range.

B. Fire-rated steel doors.
   1. Performance Criteria:
      a. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
         1) Provide units listed and labeled by UL.
         2) Attach fire rating label to each fire rated unit.
      b. Grade: ANSI A250.8 Level 3, physical performance Level C, Model 2, seamless.
      c. Thickness: 1-3/4 inches.
      d. Interior Doors, Fire-Rated:
      e. Exterior Doors, Fire-Rated:
         1) Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
         2) Insulating Value: U-value of 0.30, when tested in accordance with ASTM C1363.
   2. Features:
      a. Door Top and Closures: Steel, Flush with top of faces and edges.

b. Door Edge Profile: Beveled on both edges.
c. Face Texture: Smooth.
d. Glazed Lights: Sizes and configurations as indicated on drawings. Provide secure glazing stops on secure side of door.
    1) Glazing: In accordance with 2012 IBC 716 Tables.
        a) Fire Protective Glazing as specified in Section 088000 if door rating is 45 minutes or less and lite size is under 100 square inches.
        b) Fire Resistive Glazing as specified in Section 088000 if door rating is over 45 minutes or lite size is over 100 square inches.
e. Color: To be selected by Architect from manufacturer's full range.
f. Finish: Factory primed for field finishing.

C. Non-Fire Rated Frames:
    1. Performance Criteria:
        a. Comply with the requirements of grade specified for corresponding door.
        b. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 2.
        c. Frames for Glass: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage.
    2. Features:
        a. Completed Health Product Declaration in accordance with Section 016119 - Chemicals of Concern Restrictions.
        b. Assembly: Fully welded.
        c. Finish: Factory primed, for field finishing.

D. Fire Rated Frames:
    1. Performance Criteria:
        a. Comply with the requirements of grade specified for corresponding door.
        b. Fire Rating: Same as door, labeled, tested in accordance with UL 10C ("positive pressure").
        c. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 2.
        d. Frames for Glass: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage.
    2. Features:
        a. Completed Health Product Declaration in accordance with Section 016119 - Chemicals of Concern Restrictions.
        b. Assembly: Fully welded.
        c. Finish: Factory primed, for field finishing.

E. Exterior Frames:
    1. Performance Criteria:
        a. Comply with the requirements of grade specified for corresponding door.
        b. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
        c. Provide with true thermal break.

d. Frames for Sound-Rated Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage.

2. Features:
   a. Completed Health Product Declaration in accordance with Section 016119 - Chemicals of Concern Restrictions.
   b. Assembly: Fully welded.
   c. Finish: Factory primed, for field finishing.

2.05 ACCESSORIES

A. All accessory materials required by the manufacturer for a warrantable installation of the installed products in a manner that meets the Performance and Design Criteria.

B. Glazing: As specified in Section 088000 - Glazing, factory installed.

C. Mineral Fiber Insulation: for filling frame cavities.

2.06 FINISHING

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

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

C. Field Finish: In accordance with Section 099000 - Painting and Coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.02 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

B. Coat inside of frames to be installed in masonry, with bituminous coating, prior to installation.

C. Coat inside of other frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

B. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

C. Install fire rated units in accordance with NFPA 80.

D. Seal seam at top closures after finish is applied to create a smooth surface with out groove or pits
   1. Seal with sealant Per Section 079005 - Joint Sealers.

E. Pack all all frames with insulation.

F. Coordinate installation of hardware.

G. Coordinate installation of electrical connections to electrical hardware items.

H. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: As specified in ANSI A250.8.

B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust and lubricate hardware for proper operation.

B. Adjust for smooth and balanced door movement in accordance with manufacturer's instructions.

3.06 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior storefront

1.02 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.03 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Provide glazed storefronts that comply with test-performance requirements indicated, as evidenced by reports based on Project-specific preconstruction testing or of tests performed on manufacturer's standard assemblies by a qualified testing agency.

B. Preconstruction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition.
   1. Test a minimum five production-run samples each of metal, glazing, and other material.
   2. Prepare samples using techniques and primers required for installed assemblies.
   3. Perform tests under environmental conditions that duplicate those under which assemblies will be installed.
   4. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

1.04 SUBMITTALS

A. Qualification Data: For manufacturer, installer and design engineer.

B. Delegated-Design Submittal: For assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Energy Performance Certificates: NFRC Label Certificates are required for this project including project specific, frame types, spacer types and glass types as specified in Section 088000 - Glazing. Project specific reports substantiate U-value, visual light transmission, and solar heat gain values required by the Energy Code for the project.

D. Product Data: Provide product criteria, characteristics, accessories, material descriptions, dimensions of individual components and profiles, and finishes.

E. Shop Drawings: For glazed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed Storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage templates and details.
      c. Interface with adjoining building construction
      d. referenced to detail numbers indicated on the Contract Drawings
      e. Expansion and seismic provisions.
      f. Operable units and vents
      g. Entrance Systems
      h. Glazing.
      i. Flashing and drainage.

F. Coordination Drawings: Show tie-back and intermittent stabilization anchors.
   1. Show required slab edge configuration, post tensioning locations, embedded or surface attachment anchors and channels, structural supports such as steel posts and girts, and door locations.

G. Product Test Reports:
   1. Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed storefronts, indicating compliance with performance requirements.

H. Sample: For each type of exposed finish required, in manufacturer's standard sizes.

I. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

K. Maintenance Data: For users operation and maintenance of system including:
   1. Methods for maintaining system's materials and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.
   3. Include ASTM C 1401 recommendations for postinstallation-phase quality-control program.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualification: Company specializing in the manufacture of work specified in this section with minimum 5 years experience.

B. Designer Qualifications: Professional structural engineer with 5 years of documented experience in design of this work and licensed in the location of the project.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience on projects of similar size and complexity.

1.06 MOCK-UP

A. Enclosure Visual and Performance Mock-up:
1. Construct and participate in Enclosure Visual and Performance Mock-up specified in Section 014339 - Mockups.

1.07 DELIVERY, STORAGE, AND HANDLING

A. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.

1.08 WARRANTY

A. Manufacturer’s Finish Warranty: Correct defective work within a 20 year period after Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
1. Finish Criteria are listed AAMA 2605.

B. Manufacturer Warranty: Provide 2 year warranty for system failing to resist penetration of water.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Factory fabricated and finished aluminum framing system with infill, and related flashings, anchorage and attachment devices. Systems do not typically equalize pressure or manage water intrusion within the system and are designed to bear on floor plates and be less than 12 feet tall.

2.02 PERFORMANCE AND DESIGN CRITERIA

A. The storefront system begins at the primary structural members of the building frame and the edges of concrete slabs, include all support embeds, plates, angles and ancillary framing members required for structural integrity and support of the Storefront from the building structure.

B. The Drawings:
   1. Indicate the design intent for profile, joints and configuration required together with relationship to structural frame and interior building elements.
      a. Drawings do not purport to identify or solve completely the problems of thermal or structural movement, pressure equalization, weep system, vapor retarder, fixings and anchorage, flatness and stability of facing, or moisture management.

C. General Performance: Comply with performance requirements specified, as determined by preconstruction testing of manufacturer's standard glazed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Deflection exceeding specified limits.
      b. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      c. Glazing-to-glazing contact.
      d. Sealant failure.
      e. Glass breakage.
      f. Noise or vibration created by wind and thermal and structural movements.
      g. Loosening or weakening of fasteners, attachments, and other components.
      h. Failure of operating units.

D. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
      a. For spans over 13 feet 6 inches limit deflection to L/240 + 1/4 inch.
   2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.
      a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
   3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

2.03 MATERIALS

A. Exterior storefront
   1. Basis of Design Product: 451-T by Kawneer.
      a. Substitutions for products by manufacturers other than those listed above: See Section 01 25 13
   2. Performance Criteria:

a. U-Value: 0.36 maximum based on project specific opening sizes and configurations with project specific frame types, spacer types and glass types.
b. U-Value: 0.36 maximum based on NFRC 100 gateway size with project specific frame types, spacer types and glass types.
c. Air Infiltration:
    1) Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.04 cfm/sf. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 12 lbf/sq. ft.
d. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
    1) Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
    2) Test Interior Ambient-Air Temperature: 75 deg F.
    3) Test Performance: No buckling; stress on glass; sealant failure; or excess stress on framing, anchors, and fasteners; and no reduction of performance when tested according to AAMA 501.5.

3. Features:
    a. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
    b. Sight Line: 2 inches.
    c. Depth: 4-1/2 inches.
    d. All units to have jamb and head compensating receptors.
    e. Manufacture to supply matching prefinished break metal for adjacent conditions.
    f. Finish: High Performance Organic Coatings, to match FP-1 in accordance with Section 050513 - Shop-Applied Coatings for Metal.
    g.

B. Glazing:
1. Comply with Section 08 80 00 - Glazing. Provide Tempered Safety Glazing
2. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types compatible with sealants and suitable for joint movement and assembly performance requirements.
3. Weatherseal Sealant: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
    a. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 ACCESSORIES

A. All accessory materials required by the manufacturer for a warrantable installation of the installed products in a manner that meets the Performance and Design Criteria.

B. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer. or prefinished aluminum only.

C. Framing Sealants: Manufacturer's standard sealants with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). and 100% silicone.

D. Manufacturer's recommended compensation head channels.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.02 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.04 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed Storefronts to comply with the following nonaccumulating maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.
   5. Allowances for cumulative effect of all tolerances (fabrication, assembly, thermal, seismic, building and erection) and including the work of other sections, shall be made to ensure a weatherproof installation

3.05 ADJUSTING

A. Adjust operating windows, ventilators, hardware, and accessories for smooth function and tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

B. Adjust and lubricate hardware for proper operation.

3.06 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

3.07 SCHEDULE

A. Stairs

B. Finish: Dark bronze, anodized.

END OF SECTION

SECTION 08 71 00

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, hollow metal, and miscellaneous doors as noted.

B. Hardware for fire-rated doors.

C. Thresholds.

D. Smoke and draft control seals.

E. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.

C. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.

D. DHI (KSN) - Keying Systems and Nomenclature 2019.

E. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.

F. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.

G. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

K. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

N. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
   1. Architect.
   2. Hardware Supplier’s Architectural Hardware Consultant (AHC).
   3. Hardware Installer.
   4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Hardware Supplier’s Architectural Hardware Consultant (AHC).
      d. Door Hardware Installer.
      e. Owner's Security Consultant.
      f. Cylinder Manufacturer’s Keying Consultant
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
      b. Key control system requirements.
   5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
      a. Submit in vertical format.
   3. List groups and suffixes in proper sequence.
   4. Include complete description for each door listed.
   5. Include manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
   2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
   3. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.

E. Samples for Verification:

1. Submit one (1) sample of hinge, latchset, lockset, closer, and [_____] illustrating style, color, and finish.
2. Architect will return full-size samples to Contractor.
3. Include product description with samples.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
1. Bitting List: List of combinations as furnished.

H. Keying Schedule:
1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

I. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
1. Closers: Twenty Five, minimum.
2. Exit Devices: Five years, minimum.
3. Locksets and Cylinders: Three years, minimum.
4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Door Pulls and Push Plates:
1. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.

C. Closers:
1. Provide door closer on each exterior door, unless otherwise indicated.
2. Provide door closer on each fire-rated and smoke-rated door.

D. Thresholds:
   1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.

E. Smoke and Draft Control Seals:
   1. Provide gasketing for smoke and draft control doors (Indicated as "S" on Drawings) that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

F. Weatherstripping and Gasketing:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.
   3. Fabricate as continuous gasketing, do not cut or notch gasketing material.

G. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

H. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide wall grip inserts for hollow wall construction.
   5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
   6. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated or required per manufacturer's testing requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
      a. ICC (IBC).
      b. NFPA 101.
      c. Local codes as required.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   4. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   5. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   6. Regulatory and Operational Requirements:
      a. Provide hardware for all openings, whether specified or not, in compliance with NFPA Standard No. 80, proper operation and local building code requirements. Where required, provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Label hardware, as required, for compliance with pressure testing criteria as dictated in IBC.
      b. Provide hardware which meets or exceeds handicap accessibility per local building code requirements. Conform to the Americans with Disabilities Act (ADA) of 1990 as amended by the D.O.J. September 15, 2010, as adopted by the Authority Having Jurisdiction (AHJ).
   7. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.
   1. Listed in Door Hardware Schedule: Best
   2. Substitutions: Hager, McKinney

B. Properties:
   1. Butt Hinges: As applicable to each item specified.
      a. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
      b. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
      c. Template screw hole locations.
      d. Pins: Easily seated, non-rising pins.
      e. UL 10C listed for fire-resistance-rated doors.
   2. Continuous Hinges: As applicable to each item specified.
      a. Geared Continuous Hinges: As applicable to each item specified.
         1) Non-handed.
         2) UL 10C listed for fire-resistance-rated doors.
         3) Sufficient size to permit door to swing 180 degrees

C. Finishes: See Door Hardware Schedule.

D. Grades:
   1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
   2. Continuous Hinges: Comply with BHMA A156.26, Grade 1.

E. Types:
   1. Butt Hinges: Include full mortise hinges..

F. Options: As applicable to each item specified.

G. Quantities:
   1. Butt Hinges: Three (3) hinges per leaves up to 90 inches in height. Add one (1) for each additional 30 inches in height or fraction thereof.
      a. Hinge weight and size unless otherwise indicated in hardware sets:
         1) For doors up to 36 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.134 inch and a minimum of 4-1/2 inches in height.
         2) For doors from 36 inches wide up to 42 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.145 inch and a minimum of 4-1/2 inches in height.
         3) For doors from 42 inches wide up to 48 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.
         4) For doors greater than 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.

H. Applications: At swinging doors.
   1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

I. Products:
   1. Butt Hinges:
      a. Concealed bearing, five (5) knuckle.
      b. Plain Bearing, Five (5) Knuckle.

2.04 KEYS AND CORES

A. Manufacturers:
   1. Listed in Door Hardware Schedule: Best Cormax Patented

2. Substitutions: None – facility standard

B. Properties: Complying with guidelines of BHMA A156.28.
1. Provide small format interchangeable core.
2. Provide keying information in compliance with DHI (KSN) standards.
3. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
4. Keying: Master keyed.
5. Include construction keying and control keying with removable core cylinders.
6. Do not make brass construction cores and construction control and operating keys a part of Owner's permanent keying system, nor furnish in the same keyway (or key section) as Owner, permanent keying system.
7. Key to new keying system.
8. Supply keys in following quantities:
   a. Grand Master Keys: 2 each.
   b. Master Keys: 4 each.
   c. Construction Master Keys: 2 each.
   d. Construction Keys: 25 each.
   e. Construction Control Keys: 2 each.
   f. Control Keys: 2 each.
   g. Change Keys: 4 each for each keyed core.
9. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
10. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
11. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
12. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.05 CYLINDRICAL LOCKS

A. Manufacturers:
1. Listed in Door Hardware Schedule: Best 9K
2. Substitutions: None – facility standard

B. Properties:
1. Mechanical Locks:
   a. Locksets: Comply with BHMA A156.4, Grade 1.
   b. Fitting modified ANSI A115.2 door preparation.
   c. Door Thickness Fit: 1-3/8 inches to 2-1/4 inches thick doors.
   d. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
      1) Through-bolted anti-rotational studs.
   e. Bored Hole: 2-1/8 inch diameter.
   f. Backset: 2-3/8 inches unless otherwise indicated.
   g. Latch: Single piece tail-piece construction.
      1) Latchbolt Throw: 1/2 inch, minimum.
   h. Cylinders:
      1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
   i. Lever Trim:
      1) Style: See Door Hardware Schedule.

C. Finishes: See Door Hardware Schedule.

1. Core Faces: Match finish of lockset.

D. Material: Manufacturer's standard for specified lock.

2.06 CLOSERS

A. Manufacturers:
1. Listed in Door Hardware Schedule: Best HD7016
2. Substitutions: Dorma 8916, Norton 8500

B. Properties:
1. Surface Mounted Closers: Manufacturer's standard.
a. Construction: R14 high silicon aluminum alloy or cast iron
b. Covers:
1) Type: Standard for product selected.
(a) Full.
2) Material: Plastic.
3) Finish: Painted.

C. Grades:
1. Closers: Comply with BHMA A156.4, Grade 1.
a. Underwriters Laboratories Compliance:
b. Testing Standards Compliance: Meeting requirements of UL 10C for positive pressure.

D. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.

E. Types:
1. Rack-and-pinion, surface-mounted. 1-1/2 inches (36MM) minimum bore.

F. Installation:
1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
3. At outswinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

2.07 PROTECTION PLATES

A. Manufacturers:
1. Listed in Door Hardware Schedule: Trimco
2. Substitutions: Rockwood, Ives

B. Properties:
1. Plates:
a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
b. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
1. Metal Properties: Grade 316 Stainless steel.

E. Installation:
1. Fasteners: Countersunk screw fasteners

2.08 STOPS AND HOLDERS

A. Manufacturers:
   1. Listed in Door Hardware Schedule: Trimco
   2. Substitutions: Rockwood, Ives, Don Jo

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
   1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types:
   1. Wall Bumpers: Bumper, concave, wall stop.
   2. Floor Stops: Provide with rubber bumper floor stop, heavy duty as specified.

F. Installation:
   1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.

2.09 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. Listed in Door Hardware Schedule: National Guard
   2. Substitutions: Reese, Pemko

B. Grades: Comply with BHMA A156.22.

C. Products:
   1. Weatherstripping: See Door Hardware Schedule.
   2. Door Bottom Seals:
      a. Door Sweeps: See Door Hardware Schedule.
      b. Door Shoes: See Door Hardware Schedule.

2.10 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Finish: 630; satin stainless steel. 626; brushed chrome on a brass/bronze base. 652; brushed chrome on a steel base and 689; aluminum painted, with any base material

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
   3. Mounting heights in compliance with operational and ADA Standards:

J. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

K. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.07 MAINTENANCE

A. Approximately six months after the acceptance of hardware in each area, the hardware installer shall:
   1. Return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
   2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
   3. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units.
   4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

3.08 HARDWARE SCHEDULE

MANUFACTURERS

Code	Name	
BE	Best Access Systems	Hinges, Cylinders, Locks, Closers
NA	National Guard	Gaskets, Thresholds
KN	Knox	Key Boxes
TR	Trimco	Door Stops, Flat Goods

FINISH LIST

Code	Description
626/652	Satin Chromium Plated
630	Satin Stainless Steel
689	Aluminum Painted
BLK	Black

OPTIONS

Code	Description
B4E	Beveled 4 Edges – Kick, Mop & Armor Plates Trimco)
CS	Counter Sinking Of Kick, Mop & Armor Plates (Trimco)
SSMS/EA	Stainless Machine Screws/Expansion Anchors (NGP)

Set #1 - Roof Access

Doors: 401

3	Hinges	CB191 4.5" x 4.5"	630	BE
1	Lockset	9K3-7D15D PATD	626	BE
1	Closer/Stop	HD7016 SDS	689	BE
1	Kick Plate	K0050 10" x 34" B4E-HEAVY-KP CSK	630	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Drip Cap	16 A - 4" ODW		NA
1	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA
1	Knox Box	3200	BLK	KN

NOTE: Control access from the stairwell - free egress from the roof. Verify Knox box is compatible with local jurisdiction - revise as needed. Verify threshold application.

Set #2 - Elevator Lobby

Doors: 402

3	Hinges	CB179 4.5" x 4.5"	652	BE
1	Passage Set	9K3-0N15D	626	BE
1	Closer	HD7016 SPA	689	BE
1	Kick Plate	K0050 10" x 34" B4E-HEAVY-KP CSK	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5050 B Head & Jambs		NA

Set #3 - Mechanical

Doors: 403

6	Hinges	CB191 4.5" x 4.5" NRP	630	BE
2	Flush Bolts	3917-12	626	TR
1	Lockset	9K3-7D15D PATD	626	BE
2	Closer/Stop	HD7016 SDS	689	BE
2	Kick Plate	K0050 10" x 34" B4E-HEAVY-KP CSK	630	TR
1	Weatherstrip	5075 B Head & Jambs		NA
1	Astragal Gasket	5050 B		NA
1	Drip Cap	16 A - 4" ODW		NA
2	Door Sweep	200 NA		NA
1	Saddle Threshold	426 SSMS/EA		NA
1	Knox Box	3200	BLK	KN

NOTE: Mechanical/Storage - auto flush bolts not required. Verify with local jurisdiction. Astragal on inactive leaf by door manufacturer. Verify Knox box is compatible with local jurisdiction - revise as needed. Verify threshold application.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire Rated and Safety Glazing

1.02 RELATED REQUIREMENTS

A. 08 11 13 - Hollow Metal Doors and Frames: for assembly requiring components from this section.

1.03 SUBMITTALS

A. Qualification Data: For Installer, fabricator and design engineer.

B. Delegated-Design Submittal: For assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Data:
1. Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
2. Glazing Compounds & Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements and identify available colors.

D. Shop Drawings: For any glazing installed with components from this section alone.
1. Submit shop drawings for glazing installed within other systems in accordance with the system submittal requirements.

E. Sample: Submit two samples in manufacturer's standard size of glass type units, showing coloration and design.

F. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Data: For users operation and maintenance of system including:
1. Methods for maintaining system's materials and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Provide either wire glass or Fire Protective Glazing in Hollow Metal Doors as indicated below.

2.02 MATERIALS

A. Wire Glass:
   1. Safety Glazing: Comply with 16 CFR 1201 test requirements for Category II..
   2. Polished Wired Glass as approved for fire and safety codes.

B. Fire Protective Glazing: for glazing in fire rated openings in accordance with IBC 716 Tables.
   1. Specification is based on SuperLite I-XL by SaftiFirst.
      a. Comparable products by one of the following are also acceptable. See Section 016000 - Product Requirements for submittal requirements.
         1) Pyrostop Series by Technical Glass Products.
      b. Substitutions for products by manufacturers other than those listed above: See Section 016000 - Product Requirements.
   2. Performance Criteria:
      a. Type, thickness, and configuration as required to maintain indicated ratings of fire rated assemblies.
      b. Provide products not requiring surface applied films to maintain their performance criteria. Surface applied films can be easily damaged and performance criteria compromised.
      c. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
      d. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes
   3. Features:
      a. Surface Finish: Ground and polished on both sides.
      b. Labeling: Provide permanent label on each piece giving the IBC rating and other information required by the applicable code.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.02 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.04 ADJUSTING

A. Adjust and lubricate hardware for proper operation.

3.05 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Delegated design of louvers.

1.02 RELATED REQUIREMENTS

A. 07 62 00 - Sheet Metal Flashing and Trim.

B. 07 92 00 - Joint Sealers.

C. Division 23: for louver performance requirements.

1.03 SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

D. Sample: Submit two samples 4 inch x 6 inches in size illustrating finish and color of exterior and interior surfaces.

E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

F. Maintenance Data: For users operation and maintenance of system including:
1. Methods for maintaining system's performance, materials and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to components, finishes, and performance.
3. Include lubrication schedules and adjustment requirements.

1.04 MAINTENANCE MATERIAL

A. Spare parts, extra stock, tools.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualification: Company specializing in the manufacture of work specified in this section with minimum 5 years experience.

B. Designer Qualifications: Professional structural engineer with 5 years of documented experience in design of this work and licensed in the location of the project.

1.06 MOCK-UP

A. In-place visual mockup: install one louver at Level 1 storefront for review of installation workmanship and joint detailing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.

1.08 WARRANTY

A. Manufacturer’s Finish Warranty: Correct defective work within a 20 year period after Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
   1. Panel Finish Criteria are listed AAMA 2605.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Prefinished continous alum architectural louvers with blank off panels – match storefront.

2.02 PERFORMANCE AND DESIGN CRITERIA

A. AMCA Certified in accordance with AMCA 511.

B. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.

C. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at 850 feet per minute, when tested in accordance with AMCA 500-L.

D. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.

E. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

F. Product Contents: Provide products that do not contain any components listed in Section 016119 - Chemicals of Concern Restrictions.

2.03 MANUFACTURERS

A. Specification is based on products listed below by Ruskin; www.ruskin.com.
   1. Comparable products by one of the following are also acceptable.
      a. American Warming and Ventilating; www.awv.com.
      b. PCI Industries, Inc; All-Lite Brand; www.alllite-louvers.com.
      c. Construction Specialties Inc.

2.04 FIXED LOUVERS

A. Fixed Louver:
   1. Basis of Design Product: Greenheck or approved equal. Comparable and substituted products will be judged based on the following performance criteria, features, warranty, and qualifications.
   2. Performance Criteria:
      a. Free Area: 50 percent, minimum.
      b. Static Pressure Loss: 0.15 inch wg maximum per square foot of free area at velocity of 900 fpm, when tested in accordance with AMCA 500-L.
   3. Features:
      a. Blades: Drainable.
      b. Frame: 4 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
      c. Aluminum Thickness: Frame 12 gage, 0.0808 inch minimum; blades 12 gage, 0.0808 inch minimum.
      d. Finish: In accordance with Section 050513 - Shop-Applied Coatings for Metal.
         1) Color: architect to select from manufacturer’s standards.

2.05 ACCESSORIES

A. All accessory materials required by the manufacturer for a warrantable installation of the installed products in a manner that meets the Performance and Design Criteria.

B. Blank-Off Panels: Same material as louver, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

C. Insect Screen: 18 x 16 size aluminum mesh.

D. Fasteners and Anchors: Stainless steel.

E. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

F. Sealant: type, as specified in Section 079005.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.02 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

B. Install perimeter sealant and backing rod in accordance with Section 079005.

C. Coordinate with installation of mechanical ductwork.

D. Coordinate with installation of louver actuators.

3.04 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria and warranty.

3.05 SCHEDULE

A. LVR-1: Fixed.
   1. Finish: match aluminum curtainwall.

SECTION 09 29 00
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide gypsum wallboard, plain and fire-rated, exterior grade, water-resistant, in thicknesses detailed, to walls, partitions, ceilings, and soffits, attached to metal stud framing according to industry standards.

B. Provide tape, metal trim, reveal moldings, fasteners, sealants, accessories, and insulation Work as shown and specified.

C. Finishing of gypsum wallboard, taping, filling and sanding.

D. Fire-rated duct enclosures and shaft walls.

E. Fire-Resistance Ratings: Provide gypsum drywall construction fire-resistance ratings indicated, conforming to assemblies tested per ASTM E 119 by inspecting and testing organization acceptable to authorities having jurisdiction.

1.2 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's published descriptive literature for gypsum board types, trim accessories, and control joints pertinent to this Section.

B. Warranty: Submit in accordance with Division 01 Section Closeout Procedures, for incorporation into Operation and Maintenance Manuals.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 1219 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Mock-ups: Before beginning gypsum board installation, install one mock-up for Architect's review of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply or install final decoration indicated, including texture and painting, on exposed surfaces for review of mock-ups.
2. Simulate finished lighting conditions for review of mock-ups.
3. Approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Installer Qualifications: Company specializing in Work of this Section, with minimum five (5) years documented experience in commercial quality Work of comparable scope. Recommended as qualified installer by NWCB, or approved by Architect prior to Bid

E. Regulatory Requirements:

1. Conform to requirements for tested fire-rated assemblies.
   a. GA 600, Fire Resistance Design Directory.
   b. UL, Fire Resistance Directory, or Warnok Hershey International (WH).
   c. IBC, including Tables 7A, 7B, and 7C.
   d. ICBO, Evaluation Reports and Standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide gypsum board and related products by one of the following:
   1. Georgia-Pacific Corp.
   2. United States Gypsum Co.
   3. Approved alternative in accordance with Division 01 Product Substitution Procedures and Division 01 Substitution Request Form.

2.2 MATERIALS

A. Gypsum Board (GWB): Provide gypsum board of types indicated, thickness 5/8” unless noted otherwise, in maximum lengths available to minimize end joints:
   1. Regular and Type X, at rated assemblies, tapered edges, ASTM C 36, thickness as indicated, UL labeled, and ICBO approved for fire resistive systems, as required by Code.
   2. Type C, at rated assemblies, tapered edges, ASTM C 36, thickness as indicated, UL labeled, and ICBO approved for fire resistive systems, as required by Code.

B. **Exterior Glass Fiber Reinforced Gypsum Board (Densglass-Gold**):
   1. Densglas-Gold, or Dens-Glass Gold Fireguard by Georgia-Pacific, Fiberock by U.S. Gypsum, GlasRock™ by BPB America, Inc, or approved alternative, complying with ASTM C79, ASTM C-1177, ASTM C 931, and ASTM E 136 when tested in accordance with ASTM E 119.
   2. Non-Rated and Fire Rated Assemblies: 5/8 inch, Type X, at rated assemblies, UL labeled and ICBO approved for fire resistive systems, as required by Code.

G. **Exterior Gypsum Soffit Board:** ASTM C 931, with manufacturer’s standard edges, in thicknesses indicated.
   1. CertainTeed Exterior Soffit Type X – suitable for painting.

2.3 FASTENERS AND ACCESSORIES

A. Trim Accessories: ASTM C 840: manufacturer's standard trim accessories, including cornerbead and edge trim of beaded type with face flanges for concealment in joint compound except where semi-finishing or exposed type is indicated.
   1. Provide corner bead formed from zinc alloy.
   2. Provide zinc-alloy cornerbead and edge trim for exterior gypsum board.
   3. Provide one-piece control joints with 1/4 inch wide by 7/16 inch deep slot, covered with removable tape, of roll-formed zinc or extruded vinyl as recommended by gypsum board manufacturer.
   4. As recommended by manufacturer.

B. Gypsum Board Joint Treatment Materials:

1. ASTM C 475 and ASTM C 840, and as follows: Tape and compound shall be of one manufacturer.
2. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
    a. Use open-weave glass fiber tape where recommended by manufacturer with use of setting-type joint compound.
3. Setting-Type Joint Compound: Factory-prepackaged, job-mixed chemical-hardening powder products formulated for uses indicated.
4. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements:
    a. Ready-Mix Formulation: Factory-premixed.
    b. Job-Mixed Formulation: Powder product, mixed with water at Project Site.
    c. Taping compound formulated for embedding tape and first coat over fasteners and flanges of corner beads and edge trim.
    d. Topping compound formulated for fill (2nd) and finish (3rd) coats.
    e. All-purpose compound formulated for use as both taping and topping compound.

C. Miscellaneous Materials: As follows, recommended by gypsum board manufacturer:

1. Laminating Adhesives: Product recommended by gypsum board manufacturer.
2. Fastening Adhesive for Wood: ASTM C 557.
3. Gypsum Board Screws: ASTM C 1002.
4. Gypsum Board Nails: ASTM C 514.
5. Concealed Acoustical Sealant: Comply with requirements specified in Section 07900 Joint Sealants.
6. Sound Attenuation Blankets: ASTM C 665, Type I, unfaced mineral fiber blanket insulation.
7. Resilient Metal Channels: Unimast “RC Deluxe” or approved alternative.

D. Fasteners: Screws, U.S. Gypsum, or approved, conforming to ASTM C1002. Bugle or pan head, and lengths as required to secure materials in place. Fasteners in high moisture areas to be stainless steel, hot dipped galvanized, or coated to provide corrosion resistance to 2,000 hour salt spray resistance test. High moisture areas are those areas noted as required for Green Board / Cement Board on plans. Execution

2.4 EXAMINATION

A. Verify that framing is accurately spaced and aligned. Correct framing members out of alignment, bowed or warped, to provide true, plumb, surfaces before applying gypsum board.

2.5 INSTALLATION - GENERAL

A. Install materials in accordance with ASTM C 840 and GA 216, manufacturer's instructions, requirements of regulatory agencies, and as shown.

B. Provide resilient channels and resilient isolation hangers in accordance with manufacturer’s recommendations, acoustical specifications, and as shown and specified.

2.6 INSTALLATION - WALLBOARD

A. Apply gypsum board first to ceilings and then to partitions. Apply vertically to partitions. Joints on opposite sides of same partition shall occur on different studs. Install gypsum board in moderate contact, not forced into place. Joints that do not fall over framing members shall be rejected.

B. Apply gypsum board as close as possible to floor surface to provide full backing for resilient base. If floor level is inconsistent creating voids greater than 1/4 inch, mud in voids to align flush with face of gypsum board.

C. Attach gypsum board to framed panel edges and intermediate supports with screws at 12 inches on center for ceilings, and 16 inches on center for partitions.

D. Accessories: Provide corner beads at vertical and horizontal external corners. Provide metal trim where gypsum board abuts partition or ceiling of dissimilar construction.

E. Form "floating" construction for gypsum boards at internal corners, except where special isolation or edge trim is indicated.

F. Isolate drywall construction from abutting structural and masonry Work; provide edge trim and acoustical sealant as recommended by manufacturer.

G. Install water-resistant backing board where indicated to receive finishes at tubs, showers, and similar "wet" areas.

H. Install exterior gypsum board for exterior ceilings and soffits where indicated.

I. At roof gypsum ceilings, install a strip of Tyvek® Commercial Wrap at the interface between the weather resistive barrier and the gypsum ceiling to maintain continuity of air barrier. Seal all penetrations at roof gypsum ceiling to prevent air infiltration. Use foam gasketing tape for airtight gypsum board application.

J. Screw gypsum board to wood and metal supports.

K. Screw both layers to supports where double-layer Work is indicated or otherwise required.

L. Direct Bonding: Comply with manufacturer's recommendations where gypsum board is indicated to be directly bonded to substrate.

M. Do not bridge building expansion joints. Leave space of the width indicated between boards, and trim both edges for installation of sealant or gasket.

2.7 FINISHING - GENERAL

A. Finish gypsum wallboard in accordance with the Northwest Wall and Ceiling Bureau Manual and as follows:

1. Level 1 for areas totally concealed from view in the finished Work, including partitions above ceilings to underside of structure above.
2. Level 2 for substrate surfaces of other Work.
3. Level 3 for egress stairways and storage, mechanical, electrical, communications, and maintenance areas.
4. Level 4 for surfaces to receive interior finishes (refer to Division 09).

B. Prime paint gypsum board, with PVA vapor retarder specified in Division 09 Section Paints and Coatings, before and after application of texture coat.

2.8 FINISHING - JOINTS

A. Apply joint tape and joint compound at joints, fasteners and metal trim in accordance with GA 216, and NWCB requirements for Level 4 finish. Apply compounds indicated below at accessory flanges, penetrations, fastener heads and surface defects.

1. Install compound in three coats, and prefill of cracks where recommended by manufacturer, sand between coats.

a. Embedding and First Coat: Ready-mix drying type all-purpose or taping compound.

b. Fill (Second) Coat: Ready-mix drying type all-purpose or topping compound.

c. Texture Finish Coat: Apply high solids content, flat primer of type recommended by manufacturer of texture finish. Finish shall be non-asbestos type. Spray texture shall be light "orange peel" at all exposed surfaces.

d. Texture Finish Coat: Sand finish coat when dry to leave surface flush and ready for painting specified in Division 09 Section Paints and Coatings.

B. Treat water-resistant gypsum backing board joints with tape and setting-type joint compound to comply with gypsum board manufacturer's directions.

C. Finish exterior gypsum soffit board with tape and setting-type joint compound to comply with gypsum board manufacturer's directions.

D. Provide taping and finishing using proper hand tools such as broad knives or trowels with straight and true edges or mechanical tools designed for this purpose.

E. Seal screw heads at water-resistant gypsum board with waterproof sealer.

F. Reinforce joints, corner beads and metal trim with tape. Center tape on joint and seat in joint compound. Apply skim coat to cover tape. Allow tape to dry before second coat is applied.

G. Apply second coat of joint compound over embedding coat, cover tape and feather 2 inches beyond edges leaving joint flush.

H. When second coat is dry apply third thin coat of finishing compound, feathered 2 inches beyond second coat.

I. Finish nail, screw depressions, gouges, and scratches with three (3) coats of joint compound. Leave surface of gypsum board flush, smooth, and free of tool marks and ridges.

J. Fire tape only, gypsum board surfaces in ceiling plenums. Finish other gypsum board surfaces in accordance with manufacturer's recommendations.

K. With final application of joint compound and sanding, leave gypsum board surfaces uniformly smooth to comply with NWCB Finish Level 4.

END OF SECTION

SECTION 09 90 00
PAINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide surface preparation, application of paint material, tools, equipment, services and supervision to complete exposed interior and exterior (including above roof) items and surfaces scheduled.

1. Surface preparation, prime and finish coats specified are in addition to shop-priming and surface treatments.

B. Paint exposed surfaces whether or not colors are designated in Finish Schedule, except where a surface or material is indicated not to be painted or is to remain natural. Where an item or surface is not mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.

C. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, or labels.

1. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual, or other Code-required labels, or equipment name, identification, performance rating, or nomenclature plates.

D. "Paint" includes coating systems' materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

E. Refer to Drawings and Finish Legends for type, location, and extent of finishes required, including touch-ups and field painting necessary to complete Work shown, scheduled, or specified.

F. This Section also includes installation of the building's vapor retarder (PVA Paint).

1.2 REFERENCES

A. PDCA - Painting & Decorating Contractors of America - National Office:

PDCA
3913 Old Lee Highway, Suite 33-B
Fairfax, Virginia 22030-2433

T: (703)359-0826
F: (703)359-2576
www.pdca.org

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical information, label analysis, and application instructions for each paint material proposed for use.

1. List each material and cross-reference specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.

2. Vapor retarding primer paint manufacturer to provide test data demonstrating that primer achieve minimum perm rating when installed on gypsum wallboard.

B. Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate; define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture is achieved.

1. Submit samples for the Owner's and Architect's review of color and texture only:

a. 8-inch x 10-inch brush-out cards for each color.

C. Extra Stock: Provide to the Owner, in original unopened containers, five gallons of each top coat for touch up purposes. Label for positive identification. Store where directed.

D. Mockups: Apply benchmark samples of each paint.

E. Warranty.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers, block fillers, undercoat paint produced by the same manufacturer as the finish coats.

B. Coordination of Work: Review sections in which primers are provided to ensure compatibility of the total systems for various substrates.

1. Notify the Owner of problems anticipated using the materials specified.

C. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

D. Paint manufacturers and products used shall be as listed under the "Approved Products" section of the PDCA Manual unless noted otherwise.

E. Only qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting and decorating Work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

F. Materials Not Specifically Noted: Materials not specifically noted in the "Architectural Specification Manual," latest edition, and required for the Work such as linseed oil, shellac, thinners or other materials required for the Work, shall be of quality not less than required by applicable published Federal or State Specification Standards, and as manufactured by approved firms.

G. Conform to the standards contained in the Painting and Decorating Contractor's Association Architectural Specification Manual, latest edition (hereafter referred to as PDCA Manual).

H. Material Quality: Provide the manufacturer's best quality trade sale type paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.

2. Products that comply with performance requirements of applicable Federal Specifications, yet differ in composition, may be considered for use when acceptable to the Owner. Furnish material data and manufacturer's certificate of performance to Owner for proposed substitutions.

I. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section Project Meetings.

J. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect to designate items or areas required.

2. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

K. Five (5) to 10 samples of installed vapor retarding PVA primer paint should be taken to determine if proper mil thickness is achieved and to determine the vapor permeance of the primer.

1.5 WARRANTY

A. Supply a written warranty dated for one (1) year from the date of Final Acceptance by the Owner or notice of completion, whichever occurs later. The warranty shall state that Work executed under this Section is free from defects of material and workmanship and that the Contractor, at his own expense, shall repair and replace defective Work, or Work that becomes defective, during the term of the warranty.

1.6 PROJECT CONDITIONS

A. Do not apply paint in snow, rain, fog or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

B. Do not apply paint finish in areas where dust is being generated.

C. Temperature, Humidity, and Moisture Control shall conform to the following:

D. Temperatures: Do not perform painting when temperatures on the surfaces, or the air in the vicinity of the painting Work, are below 41 degrees F.

1. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

2. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

3. The minimum temperatures allowed for latex paints shall be 45 degrees F (Exterior Work) unless specifically approved by the Owner.

E. Relative Humidity: Do no painting when it is higher than 85%.

F. Moisture of Surfaces: Use electronic "moisture meter" testing method.

G. Wallboard: Maximum moisture content allowed is 12%.

H. Masonry, Concrete, Concrete Block: Maximum moisture content allowed is 12% for solvent type paint.

I. Wood: Maximum moisture content allowed is 15%.

J. Concrete Floors: Test for moisture by a simple "cover patch test".

K. Lighting: Do not proceed with painting and decorating Work unless a minimum of 15 candle power/square foot of lighting is provided on the surfaces to be painted in accordance with PDCA Manual, latest edition.

L. Conform to PDCA and manufacturer's requirements.

M. Ventilation: Areas where painting and decorating Work is proceeding require adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 45 deg F for 24 hours before and after paint application. Provide heating and ventilating as required for the faithful performance of this section's Work in accordance with PDCA Manual, latest edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Paint exterior surfaces in accordance with MPI Manual requirements.

B. See Drawings and Finish Legends for interior paints colors and manufacturers.

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 manufacturers of topcoat for use in paint system and on substrate indicated.

D. Metal Primers: Polyamide epoxy.

E. Wood Primers: Exterior Alkyd Wood Primer: MPI #5.

1. VOC Content: E Range of E3.

F. Exterior Paints for Metals: Acrylic Urethane.

G. PVA primer paint, including mil thickness, is required to achieve code required performance of 1 perm.

H. VOC Content: All interior paints shall comply with VOC chemical component limits of Green Seal Environmental Standard GS-11 Green Seal Organization: (202) 872-6400, www.greenseal.org.

1. Flat Paints and Coatings: VOC not more than 50 g/L.

2. Non-Flat Paints and Coatings: VOC not more than 150 g/L.

3. Anti-Corrosive Coatings: VOC not more than 250 g/L.

4. Varnishes and Sanding Sealers: VOC not more than 350 g/L.

5. Stains: VOC not more than 250 g/L.

6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds.

7. Restricted Components: Paints and coatings shall not contain acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, or vinyl chloride.

I. Basis of Design Paint Product:

1. Benjamin Moore, Regal Select

J. Acceptable Stain Product (over Cedar) - not used:

1. Cabot #3000 clear penetrating stain and sealer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with requirements. Do not begin application until unsatisfactory conditions have been corrected. Start of Work implies acceptance of conditions.

3.2 PREPARATION - GENERAL

A. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and items in place that are not to be painted, or provide protection prior to surface preparation and painting.

B. Remove items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting, reinstall items removed using workmen skilled in the trades involved.

C. Clean surfaces before applying paint or surface treatments. Schedule cleaning and painting so dust and other contaminants will not fall on wet, newly painted surfaces.

3.3 SURFACE PREPARATION

A. Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material not included in the following.

B. Notify Owner in writing of problems anticipated using specified finish coat material with substrates primed by others.

C. Cementitious Surfaces:

1. Prepare concrete, cement plaster and similar surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze.

2. Use abrasive blast cleaning if recommended by paint manufacturer.

3. Determine alkalinity and moisture content of surfaces to be painted. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

D. Wood:

1. Clean surfaces of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth, and dust off.

2. Seal tops and bottoms of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.

E. Ferrous Metals:

1. Clean non-galvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.

2. Touch-up shop-applied prime coats that have been damaged and bare areas. Wire-brush, clean with solvents and touch-up with the same primer as the shop coat.

F. Galvanized Surfaces:

1. Clean galvanized surfaces with non-petroleum based solvents so that surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock, by mechanical methods.

3.4 MATERIALS PREPARATION

A. Mix and prepare paint in accordance with manufacturer's directions.

B. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain before using.

C. Use only thinners approved by manufacturer, and only within recommended limits.

3.5 APPLICATION

A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

B. Provide finish coats that are compatible with primers used.

C. The number of coats and film thickness required is the same regardless of application method. Do not apply succeeding coats until previous coat has cured. Sand between applications where required to produce a smooth, even surface.

D. Apply additional coats when undercoats or other conditions show through final coat, until paint film is of uniform finish, color, and appearance.

E. The term "exposed surfaces" includes areas visible when permanent or built-in items are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.

F. Scheduling Painting: Apply first-coat to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable, and before subsequent surface deterioration. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried.

G. Minimum Coating Thickness: Apply materials at the manufacturer's recommended spreading rate. Provide total dry film thickness of the system as recommended by the manufacturer.

H. Block Fillers: Apply block fillers at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before application of finish coats, apply a prime coat as recommended by the manufacturer to material required to be painted or finished, and has not been prime coated by others.

J. Omit primer on metal surfaces that have been shop-primed.

K. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat to assure a finish coat with no burn-through or other defects due to insufficient sealing.

L. Brush or Roll Application: Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Draw neat glass lines and color breaks.

1. Apply primers and first coats by brush unless manufacturer's instructions permit use of mechanical applicators.

M. Mechanical Applications: Use mechanical methods for paint application when permitted by manufacturer's recommendations, governing ordinances, and trade union regulations.

1. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of two (2) coats in one pass, unless recommended by the manufacturer.

N. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint Work not in compliance with specified requirements.

3.6 FIELD QUALITY CONTROL

A. The Owner may engage the services of an independent testing laboratory to sample paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.

B. The testing laboratory will perform appropriate tests as required by the Owner.

C. If tests show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, and remove non-complying paint, pay for re-testing, repaint surfaces coated with rejected paint, remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.7 MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment occurring in finished areas as well as inside cupboards and cabinet Work. Color and texture to match adjacent surfaces, except as noted otherwise. Coordinate with mechanical trades applying banding and labeling after pipes have been painted.

B. Paint fire sprinkler risers in stairways.

C. Paint gas piping gas standard yellow where visible in service spaces.

D. Paint surfaces inside of ductwork, and elsewhere behind grilles, where visible, using primer and one coat of matte black paint.

E. Paint both sides and all edges of plywood backboards for equipment before installation.

F. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.8 CLEANING AND PROTECTION

A. Clean-Up: At the end of each Work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing, scraping or other proper methods, using care not to scratch or damage adjacent finished surfaces.

C. Protect Work of other trades, whether to be painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Owner.

D. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their Work, after completion of painting operations.

E. At completion of construction activities of other trades, touch-up and restore damaged or defaced painted surfaces.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide an opaque silicone elastomeric architectural coating at following locations:

1. Back Side of Parapets
2. Steel Braces to Pitch Pockets

1.02 REFERENCES

A. ASTM D 412 - Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

B. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including surface preparation and application.

C. Color Samples submit manufacturer's color samples.

D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

E. Warranty: Submit manufacturer's standard warranty.

1.04 QUALITY ASSURANCE

A. Mock-Ups:

1. Prepare field mock-up of coating for each type of surface using same materials, tools, equipment, and procedures intended for actual surface preparation and application under actual use and environmental conditions.
2. Verify effectiveness of surface preparation.
3. Verify performance of coating.
4. Verify coating adhesion to substrate as specified under Field Quality Control in this section.
5. Require attendance of Contractor, A/E, applicator, and manufacturer's representative to observe preparation of mock-ups and to witness adhesion test.
6. Obtain A/E's approval of mock-ups.
7. Approval by Pioneer Square Preservation Board is required. See Section 01 33 00 - Submittal Procedures.
8. Retain mock-ups to establish intended standards by which coating will be judged.

B. Pre-application Meeting: Convene a pre-application meeting two weeks or as required by A/E, or owner’s agent before start of application of coating. Require attendance of parties directly affecting work of this section, including Contractor, A/E, applicator, and manufacturer's representative. Review examination, surface preparation, application, field quality control, cleaning, protection, and coordination with other work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Product name.
2. Manufacturer.
3. Batch or lot number.
4. Date of manufacture.
5. Use-before date.

B. Storage:

1. Store materials in a clean, dry area indoors in accordance with manufacturer's instructions.
2. Store materials within temperature range in accordance with manufacturer's instructions.
3. Keep containers sealed until ready for use.
4. Do not use materials after manufacturer's use-before date.

C. Handling: Protect materials from damage and contamination during handling and application.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not apply coating to surfaces that are wet, damp, or contain frost.

B. Do not apply coating when air or surface temperature is below 40 °F (4 °C), or above 120 °F (49 °C).

C. Do not spray coating in winds above 15 mph.

D. Ensure a minimum of 2 hours of adequate temperature and humidity remain before start of nightfall or inclement weather, before applying coating.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Momentive Performance Materials, 877.943.7325 http://www.siliconeforbuilding.com/home; technical contact: Gene Dorman: 951-201-2000

B. Other Acceptable Manufacturer’s:

1. Dow Corning; 1-800-248-2481
2. Pecora; 1-800-523-6688

2.02 SILICONE ELASTOMERIC ARCHITECTURAL COATING

A. Coatings:

1. Opaque wall coating - GE SEC 2400 SilShield

B. Transition Membrane: GE UST2200 UltraSpan* available in 6” or 12” wide rolls; or GE US1100 UltraSpan* available in 1, 1.5, 2, 3, 4, or 5 inch widths. Rolls are 100 ft. in length.

C. Detail Sealant/Adhesive: GE SilPruf* SCS2000.

D. Description: One-component, elastomeric, silicone, high-solids, UV resistant, architectural coating.

E. Properties, As Supplied:

1. Density, WPSTM P 14: 10.45 pounds per gallon.
2. Solids Content, By Volume, WPSTM C 19: 66 percent.
3. Solids Content, By Weight, WPSTM C 19: 72 to 81 percent.
4. Tack-Free Time, WPSTM E 86: 2 to 4 hours.
5. Skin-Over Time: 30 minutes.
6. Viscosity, WPSTM C 560: 9,000 centipoise.
7. Volatile Organic Content (VOC), EPA Method 24: 247 g/L.

F. Properties, As Cured:

1. Tensile Strength, ASTM D412: 200 psi.
2. Elongation, ASTM D412: 400 percent.

G. Colors: To match existing window frame and stucco panel above fire door, and exposed steel lintels. Assume three (3) colors.

H. Primer: Compatible with surfaces and coating. Approved by manufacturer. Most applications do not require the use of a primer. Verify coating adhesion to substrate as specified under Field Quality Control in Section 1.5.A.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive coating. Notify A/E if conditions are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Remove dirt, dust, oil, grease, rust, mildew, chalk, efflorescence, concrete laitance, concrete form release agents, concrete curing compounds, loose particles, other bond breaking contaminants, and unsound materials.

1. Solvents shall not be used on concrete. Concrete must be free of release agents, curing compounds, or other adhesion inhibiting contaminants.

C. Allow concrete and mortar to cure for a minimum of 30 days before coating.

D. Fill cracks and holes with approved patching materials and sand smooth.

1. All cracks greater than hairline width, approximately 1/ 16 inch, must be ground out and patched with an appropriate masonry patching compound. Structural cracks of any thickness must be repaired and stabilized to prevent movement.

E. Repair and stabilize structural cracks with approved repair materials.

F. Protect surrounding areas and surfaces not intended to be coated from damage during surface preparation and application.

1. Misapplied uncured or partially cured coating on non-porous surfaces shall be removed by wiping with dry cloths or cloths wet with mineral spirits followed by dry cloths. Cured

coating may be removed from nonporous surfaces such as glass or metal by razor scraping. Removal from porous surfaces such as stone, concrete or wood should be attempted as described above for nonporous surfaces. Plants and animal life should be removed from exposure or provided with positive protection from overspray or misapplication of coating.

2. Removal of misapplied coatings is the responsibility of the applicator.

3. After the coating is applied, the contractor shall remove all masking and other protection and clean up any remaining defacement caused by this work.

3.03 APPLICATION

A. Apply uniform, pinhole-free coating in three (3) separate coats at spreading rate required to achieve a total dry film thickness of 0.012 to 0.014 inch (12 to 14 mils). Apply coating in accordance with manufacturer's instructions at locations indicated on the drawings.

1. Each application should be applied at a wet thickness of 0.075 inches (7.5 mils WFT) per coat. On a smooth surface the theoretical application rate is 100 $ft.^2$/gallon per coat. Wet coating thickness may be estimated by using a wet film thickness gauge. Square foot application rates are theoretical and are for estimation purposes only. A mockup must be applied to determine the actual square rate needed to provide a pinhole free film at the recommended dry film thickness.

2. The second and third coat may be applied when the first coat is tack free to the touch. A tack free condition will usually take at least one (1) hour at 70-80 º F.; cooler temperatures may require more time. Full curing will usually take 7-10 days and can be verified by absence of solvent odor.

B. Ensure surfaces to receive coating are clean, dry, structurally sound, and free of frost and frozen materials. Application at temperatures below 50º F should be done with caution due to the possibility of dew or frost on the surface and long drying time.

C. Do not dilute coating without consulting with Momentive Technical Services.

D. Keep containers closed when not in use to avoid contamination.

E. Apply primer, if required, on wood and metallic surfaces in accordance with manufacturer's instructions. Allow primer to dry before applying coating.

F. Ensure silicone sealants to be coated are fully cured and clean.

G. Avoid over spray of coating. Remove over spray and misapplied coating immediately and before it has cured in accordance with manufacturer's instructions. Repair or replace surfaces damaged by overspray or misapplied coating as determined by A/E.

3.04 FIELD QUALITY CONTROL

A. Verify total dry film thickness of coating is as specified using dry film gauge. Coating thickness may be verified by measuring the thickness of the cured coating piece with a micrometer.

B. Verify coating adhesion to substrate following full cure. Cut small X in coating down to substrate.

C. Start at crossover point of X and lift an edge of coating with sharp blade until it can be held with fingertips. It should not be possible to peel coating from surface. Good adhesion will be evidenced by breaking of coating film. Repaint adhesion test area.

D. Check coating for film characteristics or defects that would adversely affect performance or appearance.

E. Correct nonconforming work.

3.05 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.06 PROTECTION

A. Protect applied coating from rain or damage until fully cured.

END OF SECTION

SECTION 21 10 00
BIDDER DESIGN PROVISIONS, FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Conform to General and Supplementary Conditions, the modifications thereto and Division01 General Requirements for all Work in Division 21.

B. Refer to Instructions to Bidders by General Contractor.

1.2 SCOPE OF WORK

A. Systems: Provide design, labor, materials and appliances and perform operations in connection with satisfactory installation of mechanical Work ready to operate in strict accordance with these Specifications and Drawings.

B. Facilities: Provide fire suppression systems for Project to meet applicable codes.

1.3 SUBMITTALS

A. Shop Drawings and Product data.

B. Warranty.

C. Operations and Maintenance Data.

1.4 CODES AND STANDARDS

A. Conform to following code and agency requirements having jurisdictional authority over fire suppression systems installation:

1. 2018 International Existing Building Code
2. 2018 International Building Code
3. 2018 International Mechanical Code.
4. 2018 International Plumbing Code.
5. National Electric Code.
6. Local Sewer and Water District Requirements.
7. Local Department of Health.
8. 2018 International Fire Code
9. National Fire Protection Association (NFPA)
10. Washington Industrial Safety and Health Act (WISHA)
11. Washington State Energy Code
12. ANSI 117.1 2003 for Barrier-Free Design

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION – NOT APPLICABLE

END OF SECTION

SECTION 22 00 00
PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1) Provide: To furnish and install, complete and ready for intended use.

2) Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3) Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.

4) Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5) Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 22, Plumbing Contract Documents.

B. Related Work:

1) Additional conditions apply to this Division including, but not limited to:

a) Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b) Drawings

c) Addenda

d) Owner/Architect Agreement

e) Owner/Contractor Agreement

f) Codes, Standards, Public Ordinances and Permits

2) Section 23 11 23, Facility Fuel - Natural Gas Piping and Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1) State of Washington:

a) IBC - International Building Code

b) IFC - International Fire Code

c) IMC - International Mechanical Code

d) NEC - National Electrical Code

e) UPC - Uniform Plumbing Code

f) WAC - Washington Administrative Code

g) WSEC - Washington State Energy Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1) ABA - Architectural Barriers Act
2) ADA - Americans with Disabilities Act
3) AHRI - Air-Conditioning Heating & Refrigeration Institute
4) ANSI - American National Standards Institute
5) ASCE - American Society of Civil Engineers
6) ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
7) ASHRAE Guideline 0, the Commissioning Process
8) ASME - American Society of Mechanical Engineers
9) ASPE - American Society of Plumbing Engineers
10) ASSE - American Society of Sanitary Engineering
11) ASTM - ASTM International
12) AWWA - American Water Works Association
13) CFR - Code of Federal Regulations
14) CGA - Compressed Gas Association
15) CISPI - Cast Iron Soil Pipe Institute
16) ETL - Electrical Testing Laboratories
17) EPA - Environmental Protection Agency
18) FM - FM Global
19) IAPMO - International Association of Plumbing and Mechanical Officials
20) GAMA - Gas Appliance Manufacturers Association

21) HI - Hydraulic Institute Standards
22) ISO - International Organization for Standardization
23) MSS - Manufacturers Standardization Society
24) NEC - National Electric Code
25) NEMA - National Electrical Manufacturers Association
26) NFGC - National Fuel Gas Code
27) NFPA - National Fire Protection Association
28) NRCA - National Roofing Contractors Association
29) NSF - National Sanitation Foundation
30) OSHA - Occupational Safety and Health Administration
31) SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
32) TEMA - Tubular Exchanger Manufacturers Association
33) TIMA - Thermal Insulation Manufacturers Association
34) UL - Underwriters Laboratories Inc.

D. See Division 22, Plumbing individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1) "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2) Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail or posted to ftp site. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor’s option, two separate submittals may be provided, consisting of underground work and building work. Deviations will be returned without review.

3) Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.

4) Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

a) Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

b) Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.

c) Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

d) For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.

e) See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.

5) Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6) Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7) Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8) Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9) Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10) Substitutions and Variation from Basis of Design:

a) The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

b) If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment

being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11) Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.

    a) Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.

    b) Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12) Samples: Provide samples when requested by individual Sections.

13) Resubmission Requirements:

    a) Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

        1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
        2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

14) Operation and Maintenance Manuals, Owner's Instructions:

    a) Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
        3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
        4) Include copy of startup and test reports specific to each piece of equipment.
        5) Include copy of final water systems balancing log along with pump operating data.
        6) Include commissioning reports.
        7) Include copy of pressure, flow, leakage and purity test data and air and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.

8) Include copy of valve charts/schedules.
9) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
10) Include product certificates of warranties and guarantees.
11) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b) Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration".

c) Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15) Record Drawings:

a) Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b) Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

c) At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.

d) Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.

e) See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than

Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.

I. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

J. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

C. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.8 WORK INCLUDED

A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.

B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system. Includes, but is not limited to: Low voltage electrical raceway, wiring and accessories, such as step-down transformers as necessary for function of sensors and

automatic valve and faucet controls. Supply step-down transformers and size wiring as recommended by manufacturer of plumbing trim/faucets requiring electrical low voltage connection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1) Comply with local, State of Washington, and Federal regulations relating to hazardous materials.

2) Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3) Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install equipment requiring access (i.e., drain pans, drains, control operators, valves, motors, cleanouts and water heaters) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1) Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

a) Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to

excavation. Repair any work damaged during excavation or backfilling.

b) Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c) Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1) Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

a) Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1) Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.

2) Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1) Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 22 Plumbing Sections.

B. General:

1) Earthquake resistant designs for Plumbing (Division 22) equipment and distribution, i.e. motors, plumbing systems, piping, equipment, water heaters, boilers, etc. to conform to regulations of jurisdiction having authority.

2) Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

3) Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.

4) Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings

along with seismic bracing details.

C. Piping:

1) Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

D. Provide means to prohibit excessive motion of plumbing equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1) Underground piping installation prior to backfilling.

2) Prior to covering walls.

3) Prior to ceiling cover/installation.

4) When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch:

1) Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the plumbing systems are ready for final punch.

2) Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1) Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2) Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3) Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4) Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5) Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1) Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

2) Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3) Protect bright finished shafts, bearing housings and similar items until in service.

3.7 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.8 CLEANING

A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.9 INSTALLATION

A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

1) Do not place equipment in sustained operation prior to initial balancing of plumbing systems.

2) Provide pump impellers to obtain Basis of Design design capacities.

D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.10 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1) Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.

2) In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3) See individual equipment Specifications for other painting.

4) Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5) Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

6) Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:

1) System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a) Testing and Balancing Reports

b) Cleaning

c) Operation and Maintenance Manuals

d) Training of Operating Personnel

e) Record Drawings

f) Warranty and Guaranty Certificates

g) Start-up/Test Document and Commissioning Reports

3.12 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Tests:

1) Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.

2) During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.13 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that plumbing items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.14 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize plumbing equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Pipe Supports for Plumbing Piping

2) Wall Sleeves

3) Building Attachments

4) Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.

2) Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

3) Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".

4) Install piping per SMACNA's requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. General - Provide pipe and equipment hangers and supports in accordance with the following:

1) When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.

2) Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:

1) Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
2) Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.

D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.

E. Provide seismic restraint hangers and supports for piping and equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pipe Supports for Plumbing Piping:
1) Channel Support Systems:
a) B-Line Systems Inc.
b) Anvil International, Anvit-Strut
c) Erico Hanger Co. Inc.; O-Strut Div.
d) Unistrut Corp.
e) HOLDRITE EZ-Strut Systems
f) Or approved equivalent.
2) Freestanding Roof Supports:
a) Miro
b) Nelson-Olsen Inc. / Quick "Pipe" Block
c) Eaton / B-Line / Dura-Blok
d) Mifab
e) Or approved equivalent.
3) Pipe Alignment and Secondary Supports:
a) HOLDRITE
b) Starquick
c) Or approved equivalent.

B. Building Attachments:
1) Anchor-It
2) Gunnebo Fastening Corp.
3) ITW Ramset / Red Head

4) Masterset Fastening Systems, Inc.

5) Or approved equivalent.

C. Miscellaneous Metal and Materials:

1) See Miscellaneous Metal and Materials article below.

2) Powder-Actuated Fastener Systems:

a) Gunnebo Fastening Corp.

b) Hilti, Inc.

c) ITW Ramset / Red Head

d) Masterset Fastening Systems, Inc.

e) Or approved equivalent.

2.2 PIPE SUPPORTS FOR PLUMBING PIPING

A. Plumbers Tape:

1) Not permitted as pipe hangers or pipe straps.

B. Freestanding Roof Pipe Supports:

1) Polyethylene high-density UV resistant block with foam pad or 100 percent UV resistant recycled rubber. With galvanized strut/channel.

2.3 WALL SLEEVES

A. Fabricated Accessories:

1) Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.

2.4 BUILDING ATTACHMENTS

A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Structural Engineer. Provide anchor bolts suitable for cracked concrete.

B. Anchor Bolts:

1) Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.

2) Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.

3) Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

C. Powder-Actuated Drive Pin Fasteners:

1) Powder-Actuated Drive-Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

E. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1) Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.

2) Properties: Non-staining, noncorrosive, and non-gaseous.

3) Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

2.5 MISCELLANEOUS METAL AND MATERIALS

A. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings, that are necessary for completion of the project. The Contractor is responsible for their design.

1) Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

C. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

D. Miscellaneous Materials: Provide incidental accessory materials, tools, methods and equipment required for fabrication.

E. Provide hot dipped galvanized components for items exposed to weather.

F. Use straps, threshold rods and wire with sizes required by SMACNA to support piping.

G. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1) Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.

2) Properties: Non-staining, noncorrosive, and non-gaseous.

3) Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Examination:

1) Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Coordinate with project structural engineer proper placement of inserts, anchors and other building structural attachments.

3.2 PIPE SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Supports:

1) Install pipe supports per manufacturer's suggested installation.

3.3 WALL SLEEVES

A. Fabricated Pipe Sleeves:

1) Provide steel pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.

2) Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.

3) Seal each end airtight with a resilient nonhardening sealer.

3.4 BUILDING ATTACHMENTS

A. Install within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.

B. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.

C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

E. Install powder-actuated drive pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.

F. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.

G. Anchor Bolts:

1) Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.

2) Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

H. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

I. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.

J. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:

1) Install fabricated pipe sleeve.

2) After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.

3) Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.

K. Install supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.5 MISCELLANEOUS METAL AND MATERIALS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.

END OF SECTION

SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Heat Trace Cable (Freeze Protection)

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1) Section 22 07 00, Plumbing Insulation

2) Section 26 00 00, Electrical Basic Requirements

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) UL 718K Pipe Heating Cable.

2) CSA Design 3A, 3B, 3C.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Project Record Documents: Record physical locations of thermostats.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Provide minimum heat tracing capacities per linear foot as scheduled on Drawings.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Heat Trace Cable (Freeze Protection):

1) FLX by Thermon

2) SRF by Chomalox

3) XL-Trace by Raychem

4) CLT by Nelson

5) Or approved equivalent.

2.2 HEAT TRACE CABLE (FREEZE PROTECTION)

A. General: Provide complete UL listed system of heating cables and components listed specifically for maintaining pipe temperature over entire piping system exposed to freezing temperatures.

B. Materials:

1) Cable: Self-regulating flat, flexible, low-heat density, parallel electric heater strip consisting of 2 stranded circuit conductors enclosed in semi-conductive, polymer core insulated with plastic jacket protected with tinned-copper braid. Ability to overlapped without creating hot spots and is suitable for application on plastic, copper or steel pipe.

2) Voltage: See electrical drawings. Provide power connections, end seals, splices tap-offs and tees for a complete system.

3) Controls: Thermostat with fixed setpoint of 40 degrees F, remote bulb and capillary sensor enclosed in a NEMA 4 enclosure.

C. Minimum Exposure Temperature: 150 degrees F continuous.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General: Installation to be by Division 26, Electrical.

3.2 HEAT TRACE CABLE (FREEZE PROTECTION)

A. Location: Furnish heat trace and components for piping exposed to freezing conditions.

B. Insulate piping systems after installation and testing of heating cable.

C. Install cable parallel to pipe or spiral wrap to achieve power density per linear foot of pipe to prevent freezing.

D. Heat Trace and Components are to be installed per the following:

1) Attach heat trace cable to pipe with polyester tape; increments not exceeding 1-foot.

2) Install thermostat capillary and bulb to pipe with polyester tape assuring a firm bulb contact with pipe. Install bulb without contact to heat cable. Maximum 12-inch spacing between tape.

3) Install thermostat at accessible location adjacent to pipe with minimum of exposed capillary.

4) Labeling: Provide “Electric Traced” label to outside of the pipes thermal insulation on alternating sides. Locate labels at intervals of 5 to 15-feet over entire length of heat tracing.

5) Coordinate installation with work under Division 26, Electrical for electrical service to each thermostat.

6) Coordinate application of heat tape with pipe insulation and weather jacketing.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Type 1, Glass Wool Pipe Insulation

2) Type 2, Flexible Elastomeric Insulation

3) Type 4, Cellular Glass

4) Accessories

5) Pipe Fitting Insulation Covers

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Section 22 05 33, Heat Tracing for Plumbing Piping

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Piping insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Installer qualifications.

2) Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.

3) Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

4) Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

5) Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

B. In addition, meet the following:

1) Formaldehyde Free: Should be third-party certified with UL Environment Validation.

2) Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.

3) Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.

4) Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Type 1, Glass Wool Pipe Insulation:
   1) Owens-Corning
   2) Johns Manville
   3) Or approved equivalent.

B. Type 2, Flexible Elastomeric Insulation:
   1) Insulation:
      a) Armacell LLC Armaflex
      b) K-Flex
      c) Or approved equivalent.
   2) Glue:
      a) Armacell LLC Armaflex Low VOC Adhesive
      b) K-Flex
      c) Or approved equivalent.
   3) Paint:
      a) Armacell LLC Armaflex
      b) K-Flex
      c) Or approved equivalent.

C. Type 4, Cellular Glass:
   1) Pittsburgh Corning
   2) Or approved equivalent.

D. Accessories:
   1) ITW Insulation Systems
   2) Or approved equivalent.

E. Pipe Fitting Insulation Covers:

1) Zeston Johns Manville
2) ITW Insulation Systems
3) Or approved equivalent.

2.2 TYPE 1, GLASS WOOL PIPE INSULATION

A. Glass Fiber: ASTM C547 Type I and IV; rigid molded, noncombustible.
   1) Thermal Conductivity Value: 0.27 BTU*in/(hr*sf*F) at 75 degrees F.
   2) Maximum Service Temperature: 850 degrees F to 1000 degrees F.
   3) Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.3 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

A. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.
   1) Thermal Conductivity Value: 0.25 BTU*in/(hr*sf*F) at 75 degrees F.
   2) Maximum Service Temperature of 220 degrees F.
   3) Maximum Flame Spread: 25.
   4) Maximum Smoke Developed: 50 (3/4-inch thick and below).
   5) Connection: Waterproof vapor retarder adhesive as needed.
   6) UV Protection: UV outdoor protective coating per manufacturer's requirements.

B. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.

C. Paint: Nonhardening high elasticity type, specifically manufactured as a protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.4 TYPE 4, CELLULAR GLASS

A. Cellular Glass Insulation: Pittsburgh Corning Foamglas pipe insulation fabricated in accordance with ASTM C552 and C585. Thermal conductivity of 0.33 BTU*in/(hr*sf*F) at 50 degrees F.

2.5 ACCESSORIES

A. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

B. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have same flame and smoke component ratings as insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.6 PIPE FITTING INSULATION COVERS

A. PVC Plastic Fitting Covers: Schuller Zeston 2000, Knauf Proto Fitting or approved equivalent. One-piece molded type fitting covers and jacketing material, gloss white. Connections: Tacks; pressure sensitive color matching vinyl tape.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION INFORMATION

A. Verification of Conditions:

1) Do not apply insulation until pressure testing and inspection of piping has been completed. Do not apply insulation over heat tracing temperature maintenance until system has been tested.

2) Examine areas and conditions under which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Preparation: Clean and dry surfaces to be insulated.

C. Installation:

1) Insulation: Continuous through walls, floors, and partitions except where noted otherwise.

2) Piping and Equipment:

a) Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.

D. Provide accessories as required. See Part 2 Article "Accessories" above.

E. Protection and Replacement: Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

F. Labeling and Marking: Provide labels, arrows and color coding on piping. Attach labels and flow direction arrows to jacketing per Section 22 05 53, Identification for Plumbing Piping and Equipment.

G. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).

H. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Pipe Size	Insulation Thickness
Piping with Heat Tracing	1, 2, 4	Mains =<1-1/4-inch Mains >1-1/4-inch	1-inch 1-1/2-inch

3.2 TYPE 1 , GLASS WOOL PIPE INSULATION

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions for below grade installation.

C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

E. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

3.3 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions for below grade installation.

C. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.

D. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

E. Flexible Elastomeric Tubing: Slip insulation over piping or if piping is already installed, it should be slit and snapped over piping. Joints and butt ends must be adhered with 520 adhesive.

3.4 TYPE 4, CELLULAR GLASS

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with manufacturer's instructions for below grade installation.

D. Install in accordance with manufacturer's instructions for below grade installation and exposed weather installation with jacketing.

E. Insulated Pipe Exposed to Weather: Where piping is exposed to weather, cover cellular glass insulation with aluminum jacket. Seal watertight jacket per manufacturer's recommendations. Install metal jacket with 2-inch overlap at longitudinal and butt joints with exposed lap pointing down. Secure jacket with stainless-steel draw bands 12-inches on center and at butt joints.

3.5 ACCESSORIES

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Furnish and install accessories for all insulation types listed in this Section.

3.6 PIPE FITTING INSULATION COVERS

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Non-Potable Cold Water Above Grade

2) Piping Specialties

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) NSF 61, Annex G.

2) Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.

3) Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).

4) Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.

5) Manufacturer's Standards Society (MSS) for valving and support reference standard.

6) American Water Works Association (AWWA) for Valving Assembly Standards.

7) American Society of Sanitation Engineers (ASSE) for Valving Standards.

8) American National Standards Institute (ANSI) for Piping Standards.

9) NFPA Standard 51B - “Fire Prevention in Use of Cutting and Welding Processes”.

10) Crosslinked polyethylene (PEX) pipe conforming to ASTM F876, F877 and CSA B1375, or DIN 16892 and 16893.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. See component manufacturers listed in individual articles below.

B. ADS
C. American-USA
D. Cerro
E. Charlotte
F. Clamp-All
G. Conbraco/Apollo Press
H. Elkhart
I. Enfield
J. Fuseseal
K. Gruvlok
L. Husky
M. Ideal
N. Mifab
O. Mission
P. Mueller
Q. Nibco
R. Orion
S. Shurjoint Mechanical Couplings
T. Sioux Chief
U. Spears
V. Tyler
W. Uponor
X. Viega
Y. Zurn
Z. Or approved equivalent.

2.2 GENERAL

A. Provide pipe, tube and fittings of the same type, fitting requirements, grade, class and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.

B. Manufactured materials delivered, new to the project site and stored in their original containers.

C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.3 NON-POTABLE COLD WATER ABOVE GRADE

A. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.

1) Fittings: ASME B16.18 copper.

2) Joints: ASTM B32, alloy Sn95 solder.

2.4 PIPING SPECIALTIES

A. Pipe Escutcheons:

1) Provide pipe escutcheons as specified with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.

2) Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.

3) Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General Installation:

1) Work performed by experienced journeyman plumbers. No exceptions.

2) Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.

3) Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.

B. Testing:

1) General:

a) Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.

b) Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

2) Testing of Pressurized Systems:

a) Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

b) Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

C. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.

D. Provide joints of type indicated in each piping system.

E. Sleeves:

1) Pipe Sleeves:

a) Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local AHJ requirements.

3.2 NON-POTABLE COLD WATER ABOVE GRADE

A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

B. Testing of Pressurized Systems:

1) Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

2) Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

C. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

END OF SECTION

SECTION 23 00 00
HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1) Provide: To furnish and install, complete and ready for intended use.

2) Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3) Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.

4) Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5) Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 23, HVAC Contract Documents.

B. Related Work:

1) Additional conditions apply to this Division including, but not limited to:

a) Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b) Drawings

c) Addenda

d) Owner/Architect Agreement

e) Owner/Contractor Agreement

f) Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1) State of Washington:

a) IBC - International Building Code

b) IFC - International Fire Code

c) IMC - International Mechanical Code

d) NEC - National Electrical Code

e) UPC - Uniform Plumbing Code

f) WAC - Washington Administrative Code

g) WSEC - Washington State Energy Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1) ABA - Architectural Barriers Act
2) ABMA - American Bearing Manufacturers Association
3) ADA - Americans with Disabilities Act
4) AHRI - Air-Conditioning Heating & Refrigeration Institute
5) AMCA - Air Movement and Control Association
6) ANSI - American National Standards Institute
7) ASCE - American Society of Civil Engineers
8) ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
9) ASHRAE Guideline 0, The Commissioning Process
10) ASME - American Society of Mechanical Engineers
11) ASPE - American Society of Plumbing Engineers
12) ASSE - American Society of Sanitary Engineering
13) ASTM - ASTM International
14) AWWA - American Water Works Association
15) CFR - Code of Federal Regulations
16) CGA - Compressed Gas Association
17) CISPI - Cast Iron Soil Pipe Institute
18) EPA - Environmental Protection Agency
19) ETL - Electrical Testing Laboratories
20) FM - FM Global
21) HI - Hydraulic Institute Standards

22) IAPMO - International Association of Plumbing & Mechanical Officials
23) IFGC - International Fuel Gas Code
24) ISO - International Organization for Standardization
25) MSS - Manufacturers Standardization Society
26) NEC - National Electric Code
27) NEMA - National Electrical Manufactures Association
28) NFPA - National Fire Protection Association
29) NFGC - National Fuel Gas Code
30) NRCA - National Roofing Contractors Association
31) NSF - National Sanitation Foundation
32) OSHA - Occupational Safety and Health Administration
33) SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
34) TEMA - Tubular Exchanger Manufactures Association
35) TIMA - Thermal Insulation Manufactures Association
36) UL - Underwriters Laboratories, Inc.

D. See Division 23, HVAC individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1) "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2) Provide product submittals and shop drawings in electronic format only. Electronic format must be posted to ftp site and be native/searchable PDF format. Scanned copies are not acceptable. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor’s option, four separate submittals may be provided, consisting of long lead items, underground/site work, building work, and building automation system. Deviations will be returned without review.

3) Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.

4) Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered

during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

a) Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

b) Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.

c) Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.

d) For vibration isolation of equipment, list make and model selected with operating load and deflection.

e) See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.

5) Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6) Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7) Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8) Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

9) Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10) Substitutions and Variation from Basis of Design:

a) The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

b) If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties proposing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for,

then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to bid.

11) Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.

    a) Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.

12) Samples: Provide samples when requested by individual Sections.

13) Resubmission Requirements:

    a) Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

        1) Resubmit for review until review indicates no exception taken or make "corrections as noted".
        2) When submitting drawings for Engineer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

14) Operation and Maintenance Manuals, Owner's Instructions:

    a) Submit, at one time, electronic files (native/searchable PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
        3) Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.
        4) Include product certificates of warranties and guarantees.
        5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
        6) Include copy of startup and test reports specific to each piece of equipment.
        7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
        8) Include commissioning reports.
        9) Include copy of valve charts/schedules.

10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b) Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration".

c) Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15) Record Drawings:

a) Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b) Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.

c) At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.

d) At completion of project, show changes and deviations from the Drawings in red on one set of black-line drawings. Include written Addendums, RFIs, and change order items. Make changes to Drawings in a neat, clean, and legible manner.

e) See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire

sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturers' written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, equipment, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1) Comply with local, State of Washington, and Federal regulations relating to hazardous materals.

2) Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3) Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

2.3 ACCESS PANELS

A. See Division 01, General Requirements and Division 08, Openings for products and installation requirements.

B. Confirm Access Panel requirements in Division 01, General Requirements, Division 08, Openings and individual Division 23, HVAC Sections. In absence of specific requirements in Division 01, General Requirements, comply with the following:

1) Provide flush mounting access panels for service of systems and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.

a) Ceiling access panels to be minimum 24-inch by 24-inch required and approved size.

b) Wall access panels to be minimum of 12-inch by 12-inch required and approved size.

c) Provide screwdriver operated catch.

d) Manufacturers and Models:

1) Drywall: Karp KDW.
2) Plaster: Karp DSC-214PL.
3) Masonry: Karp DSC-214M.
4) 2 hour rated: Karp KPF-350FR.
5) Manufacturers: Milcor, Elmdor, Acudor or approved equivalent.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Firestopping:

1) Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

a) Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

E. Pipe Installation:

1) Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.

2) Include provisions for servicing and removal of equipment without dismantling piping.

F. Plenums:

1) Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect/Engineer of any discrepancy.

G. Provide miscellaneous supports/metals required for installation of equipment, piping, and ductwork.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, Section 23 0548, Vibration and Seismic Controls for HVAC Equipment, and individual Division 23 HVAC Sections.

B. General:

1) Earthquake resistant designs for HVAC (Division 23) equipment and distribution, i.e. motors, ductwork, piping, equipment, etc. to conform to regulations of jurisdiction having authority.

2) Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

3) Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.

4) Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details. Coordinate exact design requirements with project Structural Engineer.

C. Piping and Ductwork:

1) Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

D. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Notify Architect and Engineer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1) Underground system installation prior to backfilling.

2) Prior to covering walls.

3) Prior to ceiling cover/installation.

4) After major equipment is installed.

5) When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1) Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the mechanical systems are ready for final punch.

2) Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1) During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.

2) Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping and ductwork, and wiring to point of connection. Where existing systems are being utilized, clean existing distribution systems (ductwork, piping, fans, air handlers) prior to connecting new ductwork or piping.

3) Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.

a) If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4) Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1) Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

2) Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.

3) Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

4) Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5) Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1) Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.

2) Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3) Protect bright finished shafts, bearing housings and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 START UP

A. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

   1) Do not place equipment in sustained operation prior to initial balancing of HVAC systems.

3.11 PAINTING

A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

   1) Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

   2) After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

   3) See individual equipment Specifications for other painting.

   4) Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

   5) Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.

   6) Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCESS PANELS

A. Confirm Access Panel requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1) Coordinate locations/sizes of access panels with Architect prior to work.

3.13 DEMOLITION

A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1) Scope:

a) It is the intent of these documents to provide necessary information and adjustments to the HVAC system required to meet code, and accommodate installation of new work.

b) Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.

c) Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.

2) Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

3.14 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1) System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a) Testing and Balancing Reports

b) Cleaning

c) Operation and Maintenance Manuals

d) Training of Operating Personnel

e) Record Drawings

f) Warranty and Guaranty Certificates

g) Start-up/Test Document

h) Commissioning Reports

3.15 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Tests:

1) Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.

2) During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.16 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.17 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Owner and how the units are sized. Submit this procedure to the Mechanical Engineer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Owner moves in if house system is used as the means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and provide any temporary power, controls, ductwork, piping, plumbing anchorage, miscellaneous steel and structural supports required to support the temporary system. Installation of the system to comply with all applicable codes and be acceptable to the Authority Having Jurisdiction (AHJ).

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Starters

2) Shaft Grounding

3) Motors

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) NEMA Premium Efficiency

2) Energy Policy Act (EPACT), latest applicable version(s) for minimum motor efficiencies.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Field Installed Motors: Installed motors to be of single type, from one source and from a single manufacturer.

2) Electrical components and materials to be UL and ETL listed/labeled as suitable for location and use.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 STARTERS

A. Manufacturers

1) Cerus

2) Eaton Electrical

3) General Electric

4) Siemens

5) Schneider Electric/Square D

B. Single Phase Motors:

1) Manual across-the-line starting switch having toggle-operated switch pilot running light and built-in thermal overload device with heating element rated not more than 115 percent motor full load current indicated on name plate of motor to be protected. Surface mount starters. Provide NEMA-1 enclosure.

2) Overload relays to be melting alloy type with a replaceable control circuit module. Thermal units to be interchangeable. Starter to be non operative if thermal unit is removed.

3) Single-phase motors with automatic controls. Provide motor-rated relay with coils rated for control voltage.

C. Starters up to Size 8 to be suitable for the addition of a minimum of three external auxiliary contacts (normally open or normally closed). Contactor, coils, and relays to perform the control functions of the associated equipment and control sequence.

D. Three Phase Motors up to and Including 15 HP:

1) Provide enclosed type magnetic across-the-line starter with thermal overload and undervoltage protection.

2) Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified. Then provide "Hand-Off-Auto" selector switch.

3) Starters for 3-phase motors to have overload protection in each of the three legs, with external manual reset.

4) Unless indicated on Drawings or in Specifications, furnish motor starters with a neon pilot light. Neon lights are required for exhaust fan switches.

5) Equip starters with integral transformer and coil for control circuit. Coordinate coil voltage with control voltage.

2.2 SHAFT GROUNDING

A. Manufacturers

1) Shaft Grounding Inc.

2) Aegis SGR Bearing Protection Ring

3) Or approved equivalent.

B. Variable Speed Motor Shaft Grounding: Shaft grounding ring; solid ring type.

C. Provide shaft grounding assembly on motors controlled by variable frequency drive. Shaft grounding device to be in the form of brush that resides on the motor shaft. Brush assembly shall be capable of tolerating misalignment and maintaining rotating contact throughout the motors life.

D. Material: Material used in the grounding assembly shall be stable material commonly used within industry that is not believed to constitute a hazardous material under Occupational Safety & Health Administration (OSHA) regulations.

E. Brushes: Specifically developed carbon compounds of sustained performance with wear life expectancy of 3 years minimum.

F. Seals: Sealed type to keep contaminants from entering the shaft grounding system in wet or severe environment applications.

G. Shaft Grounding Assembly: For clean room air handling systems, use the type that contains the wear products within a special enclosure within the shaft grounding system.

2.3 MOTORS

A. Manufacturers:

1) Lincoln Motor

2) Century Electric Motors (formerly A.O. Smith Electrical Products)

3) Baldor Electric

4) General Electric

5) Toshiba

6) Exception: Motors integral to equipment efficiency listing (EER, COP, etc.) per listing agency.

B. Construction:

1) Open drip-proof type except where specifically noted otherwise.

2) Design for continuous operation in 40 degrees C environment.

3) Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

4) Built-in thermal overload protection or externally protected with separate over-load with low-voltage release or lock-out. Quick trip device on hermetically sealed motors.

5) Service Factor: 1.15 for poly-phase motors except 1.25 for motors associated with shaft pressurization system fans and 1.35 for single phase motors.

6) Efficiency: Provide NEMA Premium Efficiency motors.

7) Motors used in conjunction with variable speed drives: Variable torque type matched for the full operating range of the variable frequency drive. As a minimum, motors to have Class F insulation, winding insulation rated for 1000 Volts and insulated bearings to prevent high frequency ground path. Loads not-to-exceed 80 percent of nameplate rating

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:

1) Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Coordinate conductor sizes with Division 26, Electrical. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.

2) For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

E. Single Phase Power, Split Phase Motors:

1) Starting Torque: Less than 150 percent of full load torque.

2) Starting Current: Up to seven times full load current.

3) Breakdown Torque: Approximately 200 percent of full load torque.

4) Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

5) Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

F. Single Phase Power, Permanent-Split Capacitor Motors:

1) Starting Torque: Exceeding one fourth of full load torque.
2) Starting Current: Up to six times full load current.
3) Multiple Speed: Through tapped windings.
4) Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

G. Single Phase Power, Capacitor Start Motors:
1) Starting Torque: Three times full load torque.
2) Starting Current: Less than five times full load current.
3) Pull-up Torque: Up to 350 percent of full load torque.
4) Breakdown Torque: Approximately 250 percent of full load torque.
5) Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
6) Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
7) Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

H. Three Phase Power, Squirrel Cage Motors:
1) Starting Torque: Between 1 and 1-1/2 times full load torque.
2) Starting Current: Six times full load current.
3) Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
4) Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
5) Insulation System: NEMA Class B or better. Use class F insulation when motors are controlled by a VFD.
6) Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
7) Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
8) Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
9) Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
10) Sound Power Levels: To NEMA MG 1.
11) Weatherproof Epoxy Treated Motors: Epoxy coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

12) Nominal Efficiency: Meet or exceed NEMA Premium Efficiency rating when tested in accordance with IEEE 112.

13) Nominal Power Factor: Minimum at full load and rated voltage when tested in accordance with IEEE 112.

I. Electronically Commutated Motors:

1) Brushless DC type motor specifically designed for intended application.

2) Permanently lubricated motor with heavy duty ball bearing type to match intended application load.

3) Operation Range: 20 percent to 100 percent of full speed (80 percent turndown).

4) Motor Efficiency: Minimum 85 percent efficient at all speeds.

5) Pre-wired to specific voltage and phase. Internal motor circuitry to convert AC power supplied to the fan to DC power.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.

B. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.

C. Provide inverter ready motors per NEMA MG1-30 for variable speed drive or soft-start starter use. Provide shaft grounding for motors over 2 HP serving variable speed drives. Provide shaft grounding and insulated bearings on motors 25 HP and larger serving variable speed drives. Shielded cable required for power wiring from variable speed drive to motor connection.

D. Unless otherwise indicated, motors 1-HP and larger to meet/exceed NEMA Premium Efficiency and latest EPACT.

E. Vertical in-line pump motors per NEMA MG1 vertical motor requirements.

F. Exception: Motors less than 250 watts, for intermittent service, motors furnished with equipment manufacturer's standard package equipment need not conform to these specifications.

G. Single phase motors for air compressors and pumps: Capacitor start type.

H. Motors located in exterior locations or wet air streams are to be of totally enclosed type.

I. Motors located in outdoor, wet/wash-down locations: Totally enclosed weatherproof epoxy-sealed type. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.

J. Disconnects: Provided by Division 26, Electrical unless specified otherwise.

K. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

3.2 STARTER INSTALLATION

A. Install starters in accordance with manufacturer's instructions.

B. Coordinate disconnect requirements and location with Division 26, Electrical if not integral to starter. If starter is installed out of line of sight of motor, provide additional disconnect at motor per code.

C. Provide NEMA housing appropriate to installation location.

D. Provide supports and install securely, in neat and workmanlike manner, as specified in NECA 1.

E. Meet mounting height and accessible location requirements per local code.

F. Provide fuses for fusible switches.

G. Select and install overload heater elements in motor starters to match installed motor characteristics.

H. Single Phase 120 Volt Starter: If not furnished as single packaged controller/disconnect, provide contactors, relays, wiring and devices necessary to match sequence of operation for equipment.

3.3 SHAFT GROUNDING INSTALLATION

A. Shaft grounding assembly installation not to affect the motor manufacturer warranty. Where the severe environment conditions require application of the shaft grounding types that are screwed into the motor shaft, the installation of the shaft grounding system performed either by the motor manufacturer or by the motor manufacturer authorized facility.

B. Bond the brush to the closest ground point using code sized green insulated stranded copper conductor per manufacturer instructions.

C. Test and verify the performance of the assembly to ensure that under no conditions the shaft exceeds 3 volts.

D. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

E. Check line voltage and phase and ensure agreement with nameplate.

F. Verify motor rotation.

3.4 MOTOR INSTALLATION

A. Electrical Service: Power wiring from source to motor termination under Division 26, Electrical.

B. Install in accordance with manufacturer's instructions. Coordinate with starter or variable speed controller with control sequence to provide necessary starter accessories.

C. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

D. Check line voltage and phase and ensure agreement with nameplate.

E. Verify motor rotation.

F. Field Quality Control:

1) Prepare for acceptance tests as follows:

a) Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.

b) Test interlocks and control features for proper operation.

c) Verify that current in each phase is within nameplate rating.

2) Testing: Perform the following field quality-control testing:

a) Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.

b) Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3) Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

a) Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.

b) Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

c) Verify bearing lubrication.

d) Verify proper motor rotation.

e) Test Reports: Prepare a written report to record the following test procedures used:

1) Test results that comply with requirements.
2) Test results that do not comply with requirements and corrective action taken to achieve compliance.

G. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

H. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION

SECTION 23 05 19
METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Pressure Gauges
2) Thermometers
3) Dial Thermometers
4) Separable Sockets
5) Thermometer Wells
6) Duct Thermometer Support Flanges
7) Differential and Filter Pressure Gauges
8) Pressure-Gauge Fittings
9) Test Plugs

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Maintenance Materials:

a) Extra gauge Oil for Inclined Manometers: One bottle.

b) Extra Pressure Gauges: One.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:

1) Trerice Model 600CB.

2) Dwyer Instruments, Inc.

3) Moeller Instrument Co., Inc.

4) Omega Engineering, Inc.

B. ASME B40.100, phosphor-bronze bourdon type, dry type.

1) Case: Cast aluminum, stem-mounted, flangeless.

2) Size: 4-1/2 inch diameter.

3) Window: Clear glass.

4) Connector: Brass.

5) Scale: White aluminum with black graduation and markings.

6) Pointer: Black, adjustable.

7) Mid-Scale Accuracy: One percent.

8) Scale: psi.

2.2 THERMOMETERS

A. Manufacturers:

1) Trerice Model BX9.

2) Ashcroft

3) Weiss

4) Marshaltown

5) Weksler

B. Adjustable Angle: Red-or blue-appearing organic liquid in glass: ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1) Size: 9-inch scale.

2) Window: Acrylic.

3) Scale: Aluminum, white background, black graduations and markings.

4) Stem: 3/4-inch NPT brass (aluminum for installation in air ducts).

5) Accuracy: 2 percent, per ASTM E 77.

6) Calibration: 0-160 with 2 degrees F graduations.

2.3 DIAL THERMOMETERS

A. Manufacturers:

1) Trerice Model 80742.

2) Ashcroft

3) Weiss

4) Marshaltown

5) Weksler

B. ASTM E 1, cast aluminum case, vapor or liquid actuated with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens, adjustable 360 degrees in horizontal plane. 180 degrees in vertical plane.

1) Size: 4-1/2-inch diameter dial.
2) Lens: Clear glass.
3) Length of Capillary: Minimum 6-feet (for remote reading if required).
4) Accuracy: 2 percent.
5) Calibration: 2 degrees F graduations.

2.4 SEPARABLE SOCKETS

A. Manufacturers:
1) Kimray
2) Weiss
3) Trerice

B. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.
1) Material: Brass, for use in copper piping.
2) Material: Stainless steel, for use in steel piping.
3) Extension-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
4) Insertion Length: To extend to center of pipe.
5) Cap: Threaded, with chain permanently fastened to socket.
6) Heat Transfer Fluid: Oil or graphite.

2.5 THERMOMETER WELLS

A. Manufacturers:
1) Ashcroft
2) Omega
3) Weiss

B. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
1) Material: Brass for use in copper piping.
2) Material: Stainless steel, for use in steel piping.
3) Extension Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
4) Insertion Length: To extend to center of pipe.
5) Cap: Threaded, with chain permanently fastened to socket.
6) Heat Transfer Fluid: Oil or graphite.

2.6 DUCT THERMOMETER SUPPORT FLANGES

A. Manufacturers:
1) Trerice
2) Ashcroft
3) Weiss

4) Marshaltown

5) Weksler

B. Description: Flanged fitting bracket for mounting in hole of duct, with threaded end for attaching thermometer.

1) Extension Neck Length: Nominal thickness of 2-inches, but not less than thickness of exterior insulation.

2) Insertion-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation lining.

2.7 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Manufacturers:

1) Orange Gauges

2) Midwest

3) Or approved equivalent.

B. Service: Air and non-combustible, compatible gases (Natural Gas option available.)

C. Wetted Materials: Consult factory.

D. Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.

E. Accuracy: Plus or minus 2 percent of full scale throughout range at 70 degrees F.

F. Pressure Limits: Minus 20 Hg to 15 PSIG.

G. Overpressure: Relief plug opens at approximately 25 PSIG standard gauges only.

H. Temperature Limits: 20 to 140 degrees F.

I. Size: 4-inch diameter dial face.

J. Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientation.

K. Process Connections: 1/8-inch female NPT duplicate high and low pressure taps, one pair side and one pair back.

L. Standard Accessories: Two 1/8-inch NPT plugs for duplicate pressure taps, two 1/8-inch pipe thread to rubber tubing adapter and three flush mounting adapters with screws.

2.8 PRESSURE-GAUGE FITTINGS

A. Manufacturers:

1) Omega

2) Weiss

3) Trerice

B. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

C. Syphons: NPS 1/4 (DN8) coil of brass turbine with threaded ends.

D. Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.9 TEST PLUGS

A. Manufacturers:

1) Petes Plug

2) Or approved equivalent.

B. Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

C. Body: Length as required to extend beyond insulation.

D. Pressure Rating: 500 PSIG (3450 kPa) minimum.

E. Core Inserts: One or two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gauge.

F. Core Material for Air, Water, Oil and Gas: 20 to 200 degrees F (minus 7 to plus 93 degrees Celsius), chlorosulfonated polyethylene synthetic rubber.

G. Test Plug Cap: Gasketed and threaded cap, with retention chain or strap.

H. Test Kit: Pressure gauge and adapter with probe, two bimetal dial thermometers, and carrying case.

1) Pressure Gauge and Thermometer Ranges: Approximately two times the system's operating conditions.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide instruments with scale ranges selected according to service with largest appropriate scale.

3.2 PRESSURE GAUGES

A. Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

B. Locations: Install in the following locations as a minimum, and elsewhere as indicated.

1) At each pump inlet and outlet.

2) At inlet and discharge of each pressure reducing valve.

3) At makeup water service outlets.

4) At inlet and discharge of each chiller and boiler.

C. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust to final angle, clean windows and lenses, and calibrate to zero.

E. Pressure Gauge Range/Graduations:

System	Pressure (PSI)	Graduations (PSI)
Condenser Water	0-100	1

3.3 THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

B. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

C. Adjust to final angle, clean windows and lenses, and calibrate to zero.

D. Thermometer Range/Graduations:

System	Temperature (degree F)	Graduations (degrees F)
Condenser Water	25-125	1

3.4 DIAL THERMOMETERS

A. Install in vertical upright position, tilted so as to be easily read at floor.

3.5 SEPARABLE SOCKETS

A. Inspect the openings in the vessel for foreign material and clean the connection ports to remove scale, chips and debris.

B. Install thermostats with separable sockets. Install the separable socket using good piping practice. Be sure to use TFE tape or pipe thread sealant on external pipe threads.

C. Never stand directly over or in front of a valve or controller when the system is pressurized.

D. Assure the separable socket is completely submerged in liquid or flow stream. Partial submersion will give erratic temperature transfer to thermostat.

E. Pack separable socket full with high temp bearing grease. This helps in heat transfer and prevents air space.

3.6 THERMOMETER WELLS

A. Install in piping in vertical upright position. Fill well with oil or graphite, secure cup.

3.7 DUCT THERMOMETER SUPPORT FLANGES

A. Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

3.8 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial cc an be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.

B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.

C. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

D. Locations: Install in the following locations, and elsewhere as indicated.

1) At each pump inlet and outlet.

2) At inlet and discharge of each pressure reducing valve.

3) At make-up water service outlets.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

3.9 PRESSURE-GAUGE FITTINGS

A. Install per manufacturer's instructions and recommendations.

B. Reference "Pressure Gauges" Article above.

3.10 TEST PLUGS

A. Locate test plugs adjacent to thermometers and thermometer sockets, adjacent to pressure gauges and pressure gauge taps, adjacent to control device sockets, or where indicated.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Balancing Valves
2) Ball Valves
3) Butterfly Valves
4) Swing Check Valves
5) Wafer Check Valves

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

B. Valves, General:

1) Apollo
2) Armstrong
3) ASCO
4) Cla-Val
5) Conbraco
6) Crane
7) Clow
8) Griswold

9) Hammond
10) Hays
11) Jenkins
12) Josam
13) Kennedy
14) Milwaukee
15) Mueller
16) Nibco
17) Red-White Valve
18) Smith
19) Stockham
20) Tour & Andersson
21) Wade
22) Watts
23) Wilkins
24) Zurn

C. Balancing Valves:
1) Griswold
2) Hays
3) Armstrong CBV
4) Tour & Andersson
5) Victaulic (T&A Valves only)

D. Ball Valves:
1) See Valves General above.
2) NSF Valves:
a) Clow
b) Kennedy
c) Nibco

E. Butterfly Valves:
1) See Valves General above.

F. Swing Check Valves:
1) See Valves General above.

G. Wafer Check Valves:
1) See Valves General above.

2.2 VALVES - GENERAL

A. General:

1) Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

2) Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6 inches and smaller. Provide gear operators for quarter-turn valves 8 inches and larger and plug valves 5 inches and larger. Provide chain-operated sheaves and chains for overhead valves installed over 5 feet above finished floor.

3) Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valves in Insulated Piping: With 2-inch stem extension and following features:

1) Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.

a) Basis of Design Product: Subject to compliance with requirements. Provide NIBCO NIB-SEAL handle extension or comparable product by one of the following.

1) Conbraco Industries, Inc.: Apollo Div.

2) Butterfly Valves: With extended neck.

C. Valve-End Connections:

1) Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.

2) Grooved: With grooves according to AWWA C606.

3) Solder Joint: With sockets according to ASME B16.18.

4) Threaded: With thread according to ASME B1.20.1.

D. Valve Bypass and Drain Connections: MSS SP-45.

E. Building Service:

1) Shutoff and Isolation Valves:

a) Pipe Sizes 3 Inches and Smaller: Ball valve.

b) Pipe Sizes 4 Inches and Larger: Butterfly valve.

2) Drain Service: Ball valves.

3) Strainer Blow-Off: Ball valve.

4) Check Valves: Swing or Wafer.

2.3 BALANCING VALVES

A. Maximum 125 PSIG System Working Water Pressure.

B. Manual Set Balancing Valves:

1) Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:

a) Precise flow measurement.

b) Precision flow balancing.

c) Positive drip-tight shutoff.

2) Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of four full 360 degree handwheel turns. 90 degree style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.

3) 2-1/2 Inches and Larger: Valve body to be either cast iron with integrated cast iron flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends (2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch: five turns; sizes 4-inch to 6-inch: 6 turns; sizes 8-inch to 10-inch: 12 turns; and size 12-inch: 14 turns. Provide flange adapters to prevent rotation.

2.4 BALL VALVES

A. Ball valves on brazed piping are to be three-piece.

B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.

C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.

D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

2.5 BUTTERFLY VALVES

A. Select lug type valves.

B. 6 Inches and Smaller: 200 PSI, ductile iron body, extended neck, stainless steel stem with stainless steel disc, reinforced resilient EPDM seat, memory stop control, lever handle through 5 inches. Mount stem in horizontal position. Manual lever and lock Nibco LD2000, Gruvlok 7700 for mechanical coupling fittings. MSS SP-67, Type 1.

2.6 SWING CHECK VALVES

A. 2 Inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80, Type 4.

B. 2-1/2 Inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MSS SP-71, Type 1.

C. Check Valve: Horizontal installation. Working pressure to 300 PSI. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

2.7 WAFER CHECK VALVES

A. Twin disc, Class 125 spring actuated designed to be installed with gaskets between two standard Class 125 flanges. 200 PSI, cast iron body, aluminum bronze disc. Nibco W-920-W.

B. Check Valve: PPS coated ductile iron body, ASTM A536, aluminum bronze nonslamming disc, stainless steel spring and shaft. Rubber seat for intended service.

PART 3 - EXECUTION

3.1 GENERAL VALVE INSTALLATION REQUIREMENTS

A. Prepare valves for shipping as follows:

1) Protect internal parts against rust and corrosion.

2) Protect threads, flange faces, grooves, and weld ends.

3) Set ball open to minimize exposure of functional surfaces.

4) Set butterfly valves closed or slightly open.

5) Block check valves in either closed or open position.

B. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.

C. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.

D. Use the following precautions during storage:

1) Maintain valve end protection.

2) Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

E. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

F. Do not attempt to repair defective valves; replace with new valves.

G. Install valves per manufacturer's recommendations.

H. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

I. Purge and clean piping to be connected to valve.

J. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.

K. Determine that the valve and its piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that mating flanges are in line and parallel to minimize straining on joints and valve body.

L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.

N. Stem Selection: Outside screw and yoke stems, except provide inside screw, nonrising stem where space prevents full opening of OS&Y valves.

O. Seats: Renewable seats, except where otherwise indicated.

P. When soldering, use paste flux that is approved by the manufacturer for use with lead-free alloys.

Q. Valve Adjusting and Cleaning:

1) Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.

2) Valve Identification: Tag valves per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

R. General Requirements for Valve Applications:

1) If valve applications are not indicated, use the following:

a) Shutoff Service: Ball or Butterfly valves.

b) Butterfly Valve Dead-End Service: Single-flange (lug) type.

c) Throttling Service: Balancing valves.

d) Provide isolation valve or check valve where indicated. Combination triple duty valves not allowed.

2) If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

3) Valves, except wafer types, with the following end connections.

a) For Copper Tubing 2 Inches and Smaller: Threaded ends.

b) For Copper Tubing 2-1/2 Inches to NPS 4 Inches: Flanged ends.

c) For Copper Tubing 5 Inches and Larger: Flanged ends.

d) For Steel Piping 2 Inches and Smaller: Threaded ends.

e) For Steel Piping 2-1/2 inches to NPS 4 Inches: Flanged ends.

f) For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.2 BALANCING VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install with flow in the direction of the arrow on the valve body and install at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Install devices in accordance with manufacturer's recommendations to automatically balance flow in piping loops as indicated.

C. For venturi valves less than 1-1/2-inch pipe size, provide valve sized for flow to coil. Provide transitions on both inlet and outlet of valve if valve is less than line size.

3.3 BALL VALVE INSTALLATION

A. See General Installation Requirements above.

3.4 BUTTERFLY VALVE INSTALLATION

A. See General Installation Requirements above.

3.5 SWING CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install in the horizontal or vertical position with upward flow. Install for proper direction of flow. Install with minimum three pipe diameters of straight pipe upstream of valve.

3.6 WAFER CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install between two flanges in horizontal or vertical position, position for proper direction of flow.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Hangers and Supports for HVAC Piping, Ductwork and Equipment

2) Wall and Floor Sleeves

3) Building Attachments

4) Flashing

5) Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.

2) Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".

3) Install ductwork and piping per SMACNA's requirements.

4) Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Welding:

a) Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".

2) Welding for Hangers:

a) Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.

3) Engineering Responsibility:

a) Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, support from floor structure, roof structure or from structure above, and seismic restraint by a qualified

Structural Professional Engineer.

1) 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 hangers and supports that are similar to those indicated for this Project in material, design, and extent.

4) Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.

5) Support systems to be supplied by a single manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:

1) When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.

2) Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:

1) Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.

2) Equipment, ductwork and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

E. Provide seismic restraint hangers and supports for piping, ductwork and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:

1) Anvil International

2) B-Line Systems, Incorporated

3) Erico Company, Incorporated

4) Nelson-Olsen Incorporated

5) Rilco Manufacturing Company, Incorporated

6) Snappitz Thermal Pipe Shield Manufacturing

7) Unistrut Corporation

B. Wall and Floor Sleeves:

1) Thunderline Corporation “Link Seal”.

2) Or approved equivalent.

C. Building Attachments:

1) Anchor-It

2) Gunnebo Fastening Corporation

3) Hilti Corporation

4) ITW Ramset/Red Head

5) Masterset Fastening Systems, Incorporated

2.2 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.

B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.

C. Channel Hanging System:

1) Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 Grade 33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.

2) Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

D. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.

E. Pipe Hangers:

1) Pipe Rings for Hanger Rods:

a) Pipe Sizes 2-inches and Smaller: Adjustable swivel ring hanger, UL listed. Erico 100 or 101, Anvil Figures 69 or 104, or approved equivalent.

b) Pipe Sizes 2-1/2-inches and Larger: Clevis type hangers with adjustable nuts on rod, UL listed. Anvil figure 260, Erico 400, or approved equivalent.

c) Pipe hangers to have same finish as hanger rods.

F. Pipe Saddles and Shields:

1) Factory fabricated saddles or shields under piping hangers and supports for insulated piping.

2) Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).

G. Riser Clamps: Steel, UL listed. MSS Type 8. Erico 510 or 511. Copper coated; Erico 368.

H. Pipe Slides: Anvil, reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.

I. Pipe Guides:

1) Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Contact with chilled water pipe not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.

2) Furnish and install guides approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.

J. Pipe Roller Hangers: Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.

K. Thermal Hanger Shield Inserts:

1) 100-PSI (690-kPa) minimum compressive strength calcium silicate insulation, encased in sheet metal shield or polyisocyanurate rigid foam exceeding the load bearing weight of the pipe at the hanger point with a PVC vapor barrier.

2) Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier or polyisocyanurate rigid foam with a PVC vapor barrier.

3) Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate or polyisocyanurate rigid foam with a PVC vapor barrier.

4) For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

5) For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

6) Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.

7) Thermal Hanger Shield Insulation Operating Temperature: Meet or exceed fluid temperature in pipe.

L. Freestanding Roof Supports: Polyethylene high-density UV resistant quick "pipe" block with foam pad.

2.3 WALL AND FLOOR SLEEVES

A. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

B. Fabricated Accessories:

1) Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.

2) Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide the following minimum gauges for the sizes indicated:

a) Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.

b) Sleeve Sizes 5-6-inches: 16 gauge.

c) Sleeve Sizes 7-inches and Larger: 14 gauge.

d) Fire-Rated Safing Material.

1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 pounds per cubic foot density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.4 BUILDING ATTACHMENTS

A. Beam Clamps:

1) MSS Type 19 and 23, wide throat, with retaining clip.

2) Universal Side Beam Clamp: MSS Type 20.

B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Anchor Bolts:

1) Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

2) Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.

3) Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.

4) Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

2.5 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.

B. Safes: 8 mil thick neoprene.

C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.6 MISCELLANEOUS METAL AND MATERIALS

A. General:

1) Provide miscellaneous supports and metal items, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.

2) Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

G. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).

H. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.

I. Grout:

1) ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

2) Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.

3) Properties: Nonstaining, noncorrosive, and non gaseous.

4) Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall", "2-Hour Fire/Smoke Barrier", and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.

D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms, elevator equipment rooms, IT rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.2 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.

B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.

C. Design hangers and supports to allow for expansion and contraction.

D. Support vertical ducts at maximum intervals of 16-feet and at each floor.

E. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

F. Use double nuts and lock washers on threaded rod supports.

G. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.

H. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps directly to roof deck. Do not support ducts from other ducts, piping or equipment.

I. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.

J. Channel Support System Installation:

1) Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

2) Field assemble and install according to manufacturer's written instructions.

K. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.

O. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

P. Horizontal Piping Hangers and Supports; Horizontal and Vertical Piping, and Hanger Rod Attachments:

1) Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems and in accordance with manufacturer's published product information.

2) Use only one type by one manufacturer for each piping service.

3) Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.

4) Pipe support spacing (pipe supported in ceiling or floor-supported) to meet latest applicable Code and manufacturer's requirements.

5) Provide copper-plated hangers and supports for uninsulated copper piping systems.

Q. Plumber's Tape not permitted as pipe hangers or pipe straps.

R. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.

S. Pipe Ring Diameters:

1) Uninsulated and Insulated Pipe, Except Where Oversized Pipe Rings are Specified: Ring inner diameter to suit pipe outer diameter.

2) Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.

T. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.

U. Pipe Support Brackets: Support pipe with pipe slides.

V. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.

W. Pipe Guides:

1) Install on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Contact with chilled water pipe does not permit heat to be transferred in sufficient quantity to cause condensation on any surface.

2) Install approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.

X. Heavy-Duty Steel Trapeze Installation:

1) Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated, heavy-duty trapezes.

2) Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

3) Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Y. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-58.

Z. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.

AA. Do not support piping from other piping.

BB. Fire protection piping will be supported independently of other piping.

CC. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.

DD. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.

EE. Insulated Piping:

1) Attach clamps and spacers to piping.

a) Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.

b) Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

2) Do not exceed pipe stress limits according to ASME B31.9.

3) Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

4) Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields to span arc of 180 degrees.

5) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

6) Shield Dimensions for Pipe, not less than the following:

a) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.

b) NPS 4 (DN100): 12-inches long and 0.06-inch thick.

c) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.

d) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.

e) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.

7) Pipes NPS 8 (DN200) and Larger: Include wood inserts.

a) Insert Material: Length at least as long as protective shield.

8) Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

FF. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

GG. Pipe Curb Assemblies:

1) Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.

2) Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.

HH. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

II. Vertical Piping:

1) Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.

2) Riser clamps to be directly under fitting or welded to pipe.

a) Riser to be supported at each floor of penetration.

b) Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

JJ. Piping Above Roof:

1) Provide engineered roof piping supports appropriate for installation and attachment to the roof structure or structure below roof (see Architectural and Structural Drawings for roof construction, building structural systems, and sloping requirements for insulation).

2) Design a complete system unless specific details have been shown on Drawings.

3) Provide calculations signed and stamped by a Structural Engineer, registered in the State where the project is located at, as part of submittals and coordinated shop drawings.

4) Do not use freestanding supports unless approved by the Structural Engineer of Record.

5) Provide miscellaneous metal and materials as specified in Miscellaneous Metal and Materials article, above.

3.3 WALL AND FLOOR SLEEVES

A. Fabricated Pipe Sleeves:

1) Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirements, and by waterproofing requirements.

2) Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.

3) Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.

4) Seal each end airtight with a resilient nonhardening sealer, UL listed, fire rated ASTM 814.

B. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:

1) Install fabricated pipe sleeve.

2) After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.

3) Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814.

C. Piping Penetrations Through Fire-Rated (One to Three Hour) Assemblies:

1) Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.

2) Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.

3.4 BUILDING ATTACHMENTS

A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.

B. Select size of building attachments to suit hanger rods.

C. Space attachments within maximum piping span length indicated in MSS SP-58.

D. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

E. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install concrete inserts before concrete is placed; fasten inserts to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

H. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.

I. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.

J. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.

K. Anchor Bolts:

1) Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.

2) Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

3.5 FLASHING

A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.

B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.6 MISCELLANEOUS METAL AND MATERIALS

A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

B. Finishes:

1) Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.

2) Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with

coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.

3) For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.

I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2) Obtain fusion without undercut or overlap.

3) Remove welding flux immediately.

4) Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

M. Provide galvanized components for items exposed to weather.

3.7 FIRE RATED SUPPORTS

A. Provide fire rated support as required by Codes.

END OF SECTION

SECTION 23 05 33
HEAT TRACING FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Heat Trace Cable (Freeze Protection).

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Section 26 00 00, Electrical Basic Requirements

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) UL 718K, Pipe Heating Cable.

2) CSA 3A, 3B, and 3C.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Project Record Documents: Record physical locations of thermostats.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Minimum heat tape capacities per linear foot as scheduled on Drawings.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Heat Trace Cable (Freeze Protection):

1) Thermon/FLX

2) Chromalox/SRF

3) Raychem/XL-Trace

4) Nelson/CLT

2.2 HEAT TRACE CABLE (FREEZE PROTECTION)

A. General: Provide complete UL listed system of heating cables and components listed specifically for maintaining pipe temperature over entire piping system exposed to freezing temperatures.

B. Materials

1) Cable: Self-regulating flat, flexible, low-heat density, parallel electric heater strip consisting of 2 stranded circuit conductors enclosed in semi-conductive, polymer core insulated with plastic jacket protected with tinned-copper braid. Ability to overlapped without creating hot spots and suitable for application on plastic, copper or steel pipe.

2) Voltage: See Electrical Drawings. Provide power connections, end seals, splices tap-offs and tees for a complete system.

3) Controls: Thermostat with fixed setpoint of 40 degrees F, remote bulb and capillary sensor enclosed in a NEMA 4 enclosure.

C. Minimum Exposure Temperature: 150 degrees F continuous.

PART 3 - EXECUTION

3.1 HEAT TRACE CABLE INSTALLATION

A. Heat Trace (Freeze Protection):

1) Location: Provide heat trace on piping exposed to freezing conditions.

2) Install cable parallel to pipe or spiral wrap to achieve power density per linear foot of pipe to prevent freezing.

3) Attach heat trace cable to pipe with polyester tape; increments not exceeding 1'-0-inches.

4) Install thermostat capillary and bulb to pipe with polyester tape assuring a firm bulb contact with pipe. Install bulb without contact to heat cable. Maximum 12-inch spacing between tape.

5) Install thermostat at accessible location adjacent to pipe with minimum of exposed capillary.

6) Labeling: Provide “Electric Traced” label to outside of the pipes thermal insulation on alternating sides. Locate labels at intervals of 5 to 15-feet over entire length of heat tracing.

7) Coordinate installation with work under Division 26, Electrical for electrical service to each thermostat.

8) Coordinate application of heat tape with pipe insulation and weather jacketing.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1) Vibration Isolation
   2) Seismic Restraint Devices
   3) Factory Finishes
   4) Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork

B. General:
   1) Vibration isolation for mechanical ductwork, piping and equipment.
   2) Seismic restraint for mechanical ductwork, piping and equipment.
   3) Seismic Certification for equipment, hangers and systems.
   4) Special inspections for systems.

C. Scope of Work:
   1) Vibration isolation and seismic restraint of new equipment and systems in existing buildings to points of connection with existing systems.
   2) Provide supplementary structural steel for seismic restraint systems. No hanging from roof deck is permitted on this project, unless specifically allowed by Structural Engineer of Record in writing prior to bid.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:
   1) Vibration Isolation:
      a) Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.
      b) Shop Drawings: Showing complete details of construction for steel and concrete bases including:
         1) Fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment and cantilever loads.
         2) Equipment mounting holes.
         3) Dimensions.

4) Size and location of concrete and steel bases and curbs.
5) Isolation selected for each support point.
6) Details of mounting brackets for isolator.
7) Weight distribution for each isolator.
8) Details of seismic snubbers.
9) Code number assigned to each isolator.

c) Design calculations: Provide calculations for selecting vibration isolators and for designing vibration isolation bases.

2) Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3) Seismic Restraint:

a) Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop drawings to be stamped by a professional Structural Engineer licensed in State of Washington.

b) Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details and indicate quantity, diameter and depth of penetration of anchors. Calculations certified by professional Structural Engineer licensed in State of Washington.

4) Seismic Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter and depth of penetration of anchors.

5) Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y and z planes.

6) Welding certificates.

7) Equipment Certification: Provide seismic certification for equipment as noted in Seismic Design Summary or schedules on Drawings.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Vibration Isolation:

a) Except for packaged equipment with integral isolators, single manufacturer selects and furnishes isolation required.

b) Deflections indicated on drawings are minimum actual static deflections for specific equipment supported.

c) Isolator Stability:

1) Size springs of sufficient diameter to maintain stability of equipment being supported. Spring diameters not less than 0.8 of compressed height at rated load.
2) Springs have minimum additional travel to solid equal to 50 percent of rated defection.
3) Springs support 200 percent of rated load, fully compressed, without deformation or failure.

d) Maximum Allowable Vibration Levels: Peak vibration velocities not exceed 0.08 in/sec. Correct equipment operating at vibration velocities that exceed this criteria.

2) Seismic Restraint:

a) Code and Standard Requirements:

1) Seismic restraint of equipment, piping and ductwork to be in accordance with latest enacted version of ASCE 7-16.

b) Confirm Seismic Control requirements in Division 01, General Requirements and Structural documents.

c) Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure be designed to resist total design seismic force prescribed in local building code:

1) Roof-mounted equipment weighing 400 pounds or greater.
2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
3) In-line duct devices connected to ductwork weighing 75 pounds or greater.

d) Where required, seismic sway bracing of suspended duct and piping meet following:

1) Pipe and duct runs requiring seismic bracing have minimum of two traverse braces and one longitudinal brace. Longitudinal (or traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
2) Seismic bracing may not pass through seismic separation joint. Pipe or duct runs that pass through seismic separation joint must be restrained within 5-feet of both sides of separation.
3) Seismic brace assembly spacing not to exceed 40-feet transverse and 80-feet longitudinal.

e) Seismic restraints may be omitted from suspended piping and duct if following conditions are satisfied:

1) For piping or ducts supported by rod hangers 12-inches or less in length from top of duct to bottom of structural support. Top connections to structure have swivel joints, eye bolts, or vibration isolation hangers for entire length of system run.
2) Lateral motion of system will not cause damaging impact with surrounding systems or cause loss of system vertical support.
3) System must be welded steel pipe, brazed copper pipe, sheet metal duct or similar ductile material with ductile connections.

C. Seismic restraints, including anchors to building structure, be designed by registered professional Structural Engineer licensed in State of Washington. Design includes:

1) Number, size, capacity and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.

2) Number, size, capacity and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test data verifying horizontal and vertical ratings of seismic restraint devices.

3) Number, size, capacity and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.

4) Maximum seismic loads to be indicated on drawings at each brace location. Drawings bear stamp and signature of registered professional Structural Engineer who designed layout of braces.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Seismic Snubber Units: Furnish replacement neoprene inserts for snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vibration Isolation:
   1) The VMC Group
   2) B-Line Systems, Inc.
   3) Kinetics Noise Control, Inc.
   4) Mason Industries, Inc.
   5) M.W. Saussé - Vibrex
   6) Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

B. Seismic Restraint Devices:
   1) The VMC Group
   2) B-Line Systems, Inc.
   3) Kinetics Noise Control, Inc.
   4) Mason Industries, Inc.
   5) M.W. Saussé - Vibrex
   6) California Dynamics Corporation
   7) Cooper B-Line Tolco
   8) Unistrut Diversified Products Co.; Wayne Manufacturing Division.
   9) Hilti, Inc.

C. Factory Finishes:
   1) Kynar 500 Fluoropolymer Coating
   2) Or approved equivalent.

D. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork:
   1) The VMC Group
   2) Kinetics Noise Control, Inc.
   3) Mason Industries, Inc.
   4) Hilti, Inc.
   5) Cooper B-Line, Inc.
   6) California Dynamics Corporation

7) Unistrut

8) ISAT, Inc.

9) Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

2.2 VIBRATION ISOLATION

A. Type 1 - Neoprene Pad: Natural rubber waffle pads, arranged in single or multiple layers, 3/4-inch thick per layer with pattern repeating on 1/2-inch centers; 50 durometer hardness; maximum loading 60 PSI. Minimum 1/4-inch thick steel load distribution plate and 1/16-inch shim plates between layers, factory cut to sizes matching requirements of supported equipment. Molded bridge with neoprene anchor bolt bushing and flat washer face to prevent metal to metal contact. Number of layers required for equipment scheduled. Mason Type: Super WMH.

B. Type FC-2A, Flexible Pipe Connector, Steel:

1) 321 stainless steel, close pitch, annular corrugated hose.

2) Exterior Sleeve: 304 stainless steel, braided.

3) Pressure Rating: 125 PSI at 70 degrees F for 12-inch and smaller pipe.

4) Joint: ANSI Class 150 carbon steel flanges.

5) Size: Use pipe sized units.

6) Minimum Allowable Offset: 3/4-inch on each side of installed center line.

7) Basis of Design: Metraflex Model MLP.

C. Type FC-2B, Flexible Pipe Connector, Copper:

1) Inner Hose: Bronze, close pitch, annular corrugated hose.

2) Exterior Sleeve: Braided bronze (for piping over 2-inches, to be 3 pound braided stainless steel).

3) Minimum Allowable Pressure Rating: 125 PSI at 70 degrees F.

4) Joint: Sweat ends.

5) Size: Use pipe sized units.

6) Minimum Allowable Offset: 3/8-inch on each side of installed center line.

7) Basis of Design: Metraflex Model BBS.

D. Type FC-2C, Flexible Pipe Connector, Gas:

1) Inner Hose: 304 stainless steel.

2) Exterior Sleeve: Braided, 304 stainless steel.

3) Minimum Allowable Pressure Rating: 150 PSI at 70 degrees F up to 4-inch pipe.

4) Joint: Threaded carbon steel.

5) Minimum Allowable Offset: 3/4-inch on each side of installed center line.

6) Basis of Design: Metraflex GASCT.

2.3 SEISMIC RESTRAINT DEVICES

A. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

B. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts and replaceable resilient isolation washers and bushings. Snubber load rating to match equipment size. Mason Type: Z-1011 or Z-1225.

1) Anchor bolts for attaching to concrete be seismic-rated, drill-in and stud-wedge or female-wedge type.

2) Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.

C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Mason Type: SCB.

D. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.4 FACTORY FINISHES

A. Provide manufacturer's standard prime-coat finish ready for field painting. Units mounted outdoors exposed to weather: Epoxy powder coated, with 1000 hour salt spray rating per ASTM B-117. For high levels of corrosion protection utilize:

1) Conform to AAMA 605.2.

2) Apply coating following cleaning and pretreatment.

3) Cleaning: AA-C12C42R1X.

4) Dry system before final finish application.

5) Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.

B. Finish:

1) Manufacturer's standard paint applied to factory-assembled and factory-tested equipment before shipping.

2) Powder coating on springs and housings.

3) Hardware be electrogalvanized. Hot-dip galvanize metal components for exterior use.

4) Baked enamel for metal components on isolators for interior use.

5) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

2.5 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. General Requirements for Restraint Components: Rated strengths, features and applications to be as defined in reports by agency acceptable to authorities having jurisdiction.

B. Structural Safety Factor: Allowable strength in tension, shear and pullout force of components be at least four times maximum seismic forces to which they will be subjected.

C. Anchor bolts for attaching to concrete to be seismic-rated, drill-in and stud-wedge or female-wedge type.

D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

E. Maximum 1/4-inch air gap and minimum 1/4-inch thick resilient cushion.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.

B. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.

C. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances is isolation efficiency to be destroyed when bolting isolators to floor.

D. Building Penetrations: Isolate water piping and ductwork penetrating wall, ceilings, floors or shafts from structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe or duct at equipment room wall.

E. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalignment shafts or bearings. Isolated equipment is to be level and in proper alignment with connecting ducts and pipes.

F. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.

G. Examination:

1) Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances and other conditions affecting performance.

2) Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

3) Proceed with installation only after unsatisfactory conditions have been corrected.

H. Testing: Perform following field quality-control testing:

1) Isolator seismic-restraint clearance.

2) Isolator deflection.

3) Snubber minimum clearances.

I. Adjusting:

1) Adjust snubbers according to manufacturer's written recommendations.

2) Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

J. Cleaning: After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt and debris.

K. Demonstration: Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain air-mounting systems. Reference Division 01, General Requirements.

3.2 VIBRATION ISOLATION

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Vibration isolators must be installed in strict accordance with manufacturer's written instructions and certified submittal data.

D. Install isolation as indicated on drawings by type and location and where indicated below.

E. Equipment Vibration Isolation Schedule:

Equipment	Size	Vibration Isolator Type	Minimum Deflection (in)
Cooling Towers	All	Type 1, FC-2	--

F. Adjusting:

1) Adjust isolators after piping systems have been filled and equipment is at operating weight.

2) Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3) Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

3.3 SEISMIC RESTRAINT DEVICES

A. Reference 3.01, General Installation Requirements.

B. Install in strict accordance with manufacturer's written instructions and certified submittal data.

C. Install and adjust seismic restraints so equipment, piping and ductwork supports are not degraded by restraints.

D. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

E. Install restraining cables at each trapeze, individual pipe hanger and hanging vibration isolated equipment. Provide restraining cables in each of the four directions of movement. Install restraining cables no less than 45 Degrees from vertical. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

F. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

3.4 FACTORY FINISHES

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Finishes to be factory-applied. No field patching or holidays allowed.

3.5 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Plastic Nameplates

2) Tags

3) Plastic Pipe Markers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Schedules:

a) Submit valve schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.

2) Submit schedule of identification type, including material, for each class of tagged item.

3) Submit locations at which Valve Schedules will be installed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.

2) Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 PLASTIC NAMEPLATES

A. Manufacturers:

1) Brady Corporation
2) Brimar
3) Champion America
4) Craftmark
5) Seton

B. Description: Engraving stock melamine plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.

1) Letter Color: White.
2) Letter Height: 1/2-inch.
3) Background Color: Black.
4) Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
5) Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

2.2 TAGS

A. Manufacturers:

1) Brady Corporation
2) Brimar
3) Champion America
4) Craftmark
5) Seton

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 2-inch diameter.

C. Metal Tags: Polished Brass with stamped letters; tag size minimum 2-inch diameter with smooth edges.

D. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.

E. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

F. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.

G. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1) Size: Approximately 4 by 7-inches.
2) Fasteners: Brass grommet and wire.
3) Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4) Color: Yellow background with black lettering.

2.3 PLASTIC PIPE MARKERS

A. Manufacturers:
1) Brady Corporation
2) Brimar
3) Champion America
4) Craftmark
5) Seton

B. Color: Conform to ASME A13.1 and ANSI Z535.1.

C. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

E. Lettering:
1) 3/4-inch to 1-1/4-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 1/2-inch high letters.
2) 1-1/2-inch to 2-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 3/4-inch high letters.
3) 2-1/2-inch to 6-inch Outside Diameter of Insulation or Pipe: 12-inch long color field, 1-1/4-inch high letters.
4) 8-inch to 10-inch Outside Diameter of Insulation or Pipe: 24-inch long color field, 2-1/2-inch high letters.
5) Over 10-inch Outside Diameter of Insulation or Pipe: 32-inch long color field, 3-1/2-inch high letters.

PART 3 - EXECUTION

3.1 GENERAL - INSTALLATION

A. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.

B. Identify piping, concealed or exposed, with plastic pipe markers.

C. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

D. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

E. Degrease and clean surfaces to receive adhesive for identification materials.

F. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

G. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.

H. Install all products in accordance with manufacturer's instructions.

I. Manual Balancing Dampers: Provide 12-inch long orange marker ribbon to end of balancing damper handle.

3.2 PLASTIC NAMEPLATES

A. Install plastic nameplates with corrosive-resistant mechanical fasteners.

B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.

C. Identify thermostats with nameplates.

3.3 TAGS

A. Use metal tags on piping 3/4-inch diameter and smaller.

B. Tag balancing valves and major dampers with balanced GPM or CFM indicated after balancing is completed and accepted.

C. Install tags with corrosion resistant chain.

D. Small devices, such as in-line pumps, may be identified with tags.

E. Identify valves with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.

F. Identify air terminal units and radiator valves with numbered plastic tags.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Install valve schedule at each mechanical room.

3.4 PLASTIC PIPE MARKERS

A. Install plastic pipe markers complete around pipe in accordance with manufacturer's instructions.

B. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) General Requirements and Procedures
2) Pump Balancing Procedures
3) Cooling Towers
4) Final Reports:
   a) Report Requirements
   b) General Report Data
   c) Cooling Towers
   d) Pumps
   e) Instrument Calibration
5) Additional Tests

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.
2) Pre-Construction Phase Report:
   a) Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:
      1) A complete set of report forms intended for use on the Project, with data filled in except for the field readings. Forms to be Project-specific.
      2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
      3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications to be included.
      4) A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems to which they apply.

3) Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.

4) Strategies and Procedures Plan: Submit two copies of the TAB strategies and step-by-step procedures as specified in Part 3 of this Section. Include a complete set of report forms intended for use on this Project.

5) Specify reports required because of editing procedures in Part 3 of this Section.

6) Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.

7) Sample Report Forms: Submit two sets of sample TAB report forms.

8) Test Instrument Calibration: Submit proof of calibration within the last 6 months.

9) Final Report.

10) Provide additional submittals to commissioning authority as dictated in Commissioning Specifications.

1.5 QUALITY ASSURANCE

A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Acceptable TAB Agencies:

a) Washington:

1) Neudorfer
2) Hardin & Sons
3) Northwest Engineering Services
4) Testcomm
5) Precision Test & Balance, Inc.

2) Balance Firm Qualifications:

a) General:

1) Procure services of independent TAB agency to balance, adjust and test water circulating and air moving equipment and air distribution or exhaust systems. Minimum experience: 5 years.
2) Provide proof of testing agency having successfully completed at least five projects of similar size and scope.

b) Testing and Balancing firm is certified by NEBB or AABC and has a NEBB Certified Professional (CP) or a AABC Test and Balancer Engineer (TBE) on staff.

c) Industry Standards: Testing and Balancing will conform to NEBB or AABC, and American National Standards Institute (ANSI) as follows:

1) NEBB: Comply with Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
2) AABC: Comply with National Standards for Total System Balance.
3) ANSI:
(a) S1.4 Specifications for sound level meters.
(b) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.
(c) ANSI S1.13 Methods for the Measurement of Sound Pressure Levels.

d) Test Observation: If requested, conduct tests in the presence of the Commissioning Authority, AHJ, Architect or the Architect's representative.

3) Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).

4) Owner Witness: Perform tests in the presence of the Commissioning Authority, Architect, Architect's Representative, or Owner's representative.

5) Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.

6) Simultaneous Testing: Test observations by the AHJ, the Owner's Authorized Representative and the engineer's representative need not occur simultaneously.

7) Do not perform TAB work until heating, ventilating, and air conditioning equipment has been completely installed and is operating continuously as required.

8) Conduct air testing and balancing with clean filters in place. Clean strainers prior to performing hydronic testing and balancing.

9) TAB Conference: Meet with the Commissioning Authority, Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.

a) Agenda Items: Include at least the following:

1) Submittal distribution requirements.
2) Contract Documents examination report.
3) TAB plan.
4) Work schedule and Project site access requirements.
5) Coordination and cooperation of trades and subcontractors.
6) Coordination of documentation and communication flow.

10) Certification of TAB Reports: This certification includes the following:

a) Review field data reports to validate accuracy of data and to prepare certified TAB reports.

b) Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

11) TAB Reports: Use standard forms from NEBB or AABC.

12) Instrumentation Type, Quantity, and Accuracy: As described in NEBB or AABC.

13) Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent of total number of terminals, or resetting of outlet, coil, or device listed in the final TAB report.

2) Guarantee: Meet the requirements of the following programs:

a) Provide a guarantee on NEBB or AABC forms stating that the agency will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1) The certified Agent has tested, adjusted, and balanced systems according to the Contract Documents.
2) Systems are balanced to optimum performance capabilities within design and installation limits.

1.7 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. TAB: Testing, Adjusting, and Balancing.

K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

L. Test: A procedure to determine quantitative performance of a system or equipment.

M. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.

N. AABC: Associated Air Balance Council.

O. NEBB: National Environmental Balancing Bureau.

P. AMCA: Air Movement and Control Association.

Q. CTI: Cooling Tower Institute.

R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.8 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.

C. Witness leakage and pressure tests carried out by Section 23 31 00, HVAC Ducts and Casings.

D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS AND PROCEDURES

A. Project Conditions:

1) Full Owner Occupancy: The Owner will occupy the site and existing building during the entire TAB period. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.

B. General Requirements:

1) Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

2) Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.

3) Where Owner occupies building during the testing period, cooperate with Owner to minimize conflicts with Owner's operations.

C. Examination:

1) Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

a) Contract Documents are defined in the General and Supplementary Conditions of the Contract.

b) Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

2) Examine approved submittal data of HVAC systems and equipment.

3) Examine Project record documents described in Division 01, General Requirements.

4) Examine Architect's and Engineer's design data, including Basis of Design, HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

5) Examine equipment performance data, including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7

through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

6) Coordinate requirements in system and equipment with this Section.

7) Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

8) Examine system and equipment test reports.

9) Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

10) Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

11) Examine equipment for installation and for properly operating safety interlocks and controls.

12) Report deficiencies discovered before and during performance of TAB procedures.

D. Preparation:

1) Prepare a TAB plan that includes strategies and step-by-step procedures.

2) Complete system readiness checks and prepare system readiness reports. Verify the following:

a) Permanent electrical power wiring is complete.

b) Hydronic systems are filled, clean, and free of air.

c) Automatic temperature-control systems are operational.

d) Equipment and duct access doors are securely closed.

e) Balance, smoke, and fire dampers are open.

f) Isolating and balancing valves are open and control valves are operational.

g) Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

h) Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.

3) Hold a pre-balancing meeting at least one week prior to starting TAB work.

a) Attendance is required by installers whose work will be tested, adjusted, or balanced.

4) Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

E. General TAB Procedures:

1) Perform TAB procedures on each system according to the procedures contained in NEBB or AABC and this Section.

2) Coordinate location of test probes prior to start of TAB procedures and make test probes available for Owner's tests after start of occupancy. Where required, cut insulation, ducts,

pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

3) Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

F. Adjustment Tolerances:

1) Hydronic Systems: Adjust to within plus or minus 10 percent of design at coils and plus or minus 5 percent at system pumps and equipment.

G. Recording and Adjusting:

1) Field Logs: Maintain written logs including:

a) Running log of events and issues.

b) Discrepancies, deficient or uncompleted work by others.

c) Contract interpretation requests.

d) Lists of completed tests.

2) Ensure recorded data represents actual measured or observed conditions.

3) Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

4) Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.

5) After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

6) Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

7) At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner's Authorized Representative, or Commissioning Agent.

3.2 PUMP BALANCING PROCEDURES

A. Determine water flow at pumps. Use the following procedures:

1) Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gauge heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.

2) Check system resistance. With valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved. Report flow rates that are not within plus or minus 5 percent of design.

3) Verify pump-motor amperage. Report conditions where actual amperage exceeds motor nameplate amperage.

4) Set calibrated balancing valves, if installed, at calculated presettings.

5) Measure flow at stations and adjust, where necessary, to obtain first balance. System components that have Cv rating or an accurately cataloged flow-pressure-drop

relationship may be used as a flow-indicating device.

6) Measure flow at main balancing station and set main balancing device or adjust pump speed to achieve flow that is 5 percent greater than design flow.

7) Adjust balancing stations to within specified tolerances of design flow rate as follows:

a) Determine the balancing station with the highest percentage over design flow.

b) Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.

c) Record settings and mark balancing devices.

8) Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

9) Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.3 COOLING TOWERS

A. Shut off makeup water for the duration of the test, and then make sure the makeup and blow-down systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1) Measure condenser water flow to each cell of the cooling tower.

2) Measure entering- and leaving-water temperatures.

3) Measure wet- and dry-bulb temperatures of entering air.

4) Measure wet- and dry-bulb temperatures of leaving air.

5) Measure condenser water flow rate recirculating through the cooling tower.

6) Measure cooling tower pump discharge pressure.

7) Adjust water level and feed rate of makeup-water system.

3.4 FINAL REPORTS

A. Report Requirements:

1) General:

a) Computer generated in PDF format and tabulated, divided, and bookmarked into sections by tested and balanced systems.

b) Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.

1) Include a list of the instruments used for procedures, along with proof of calibration.

c) Final Report Contents: In addition to the certified field report data, include the following:

1) Pump curves
2) Fan Curves
3) Manufacturers Test Data
4) Field test reports prepared by system and equipment installers

5) Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data

B. General Report Data:

1) In addition to the form titles and entries, include the following data in the final report, as applicable:

a) Title Page

b) Name and Address of TAB Agent

c) Project Name

d) Project Location

e) Architect's Name and Address

f) Engineer's Name and Address

g) Contractor's Name and Address

h) Report Date

i) Signature of TAB Agent who Certifies the Report

j) Summary of Contents, Including the Following:

1) Design versus Final Performance
2) Notable Characteristics of Systems
3) Description of System Operation Sequence if it varies from the Contract Documents

k) Nomenclature Sheets for Each Item of Equipment

l) Data for Terminal Units, including Manufacturer, Type Size, and Fittings

m) Notes to explain why certain final data in the body of reports vary from design values.

n) Test Conditions for Fans and Pump Performance Forms, Including the Following:

1) Settings for Outside-, Return-, and Exhaust-air Dampers
2) Conditions of Filters
3) Cooling Coil, Wet- and Dry-bulb Conditions
4) Face and Bypass Damper Settings at Coils
5) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter
6) Inlet Vane Settings for Variable-Air-Volume Systems
7) Settings for Supply-air, Static-pressure Controller
8) Other System Operating Conditions that affect Performance

C. Cooling Towers:

1) For cooling towers, include the following:

a) Unit Data: Include the following:

1) Unit Identification
2) Make and Type
3) Model and Serial Numbers
4) Nominal Cooling Capacity in Tons
5) Refrigerant Type and Weight in pounds

6) Water-treatment Chemical Feeder and Chemical
7) Number and Type of Fans
8) Fan Motor Make, Frame Size, rpm, and Horsepower
9) Fan Motor Voltage at Each Connection
10) Sheave Make, Size in Inches, and Bore
11) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
12) Number of Belts, Make, and Size
13) Use pump unit data below for recirculating pump in evaporative condensers, not for system used with cooling towers. For cooling towers, use pump test data below.

b) Water Test Data: Include design and actual values for the following:

1) Entering-water Temperature in Degrees F
2) Leaving-water Temperature in Degrees F
3) Water Temperature Differential in Degrees F
4) Entering-water Pressure in Feet of Head or PSIG
5) Leaving-water Pressure in Feet of Head or PSIG
6) Water Pressure Differential in Feet of Head or PSIG
7) Water Flow Rate in gpm
8) Bleed Water Flow Rate in gpm

c) Air Data: Include design and actual values for the following:

1) Duct Airflow Rate in cfm
2) Inlet-duct Static Pressure in Inches wg
3) Outlet-duct Static Pressure in Inches wg
4) Average Entering-air, Wet-bulb Temperature in Degrees F
5) Average Leaving-air, Wet-bulb Temperature in Degrees F
6) Ambient Wet-bulb Temperature in Degrees F

D. Pumps:

1) For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.

a) Unit Data: Include the following:

1) Unit Identification
2) Location
3) Service
4) Make and Size
5) Model and Serial Numbers
6) Water Flow Rate in gpm
7) Water Pressure Differential in Feet of Head or PSIG
8) Required Net Positive Suction Head in Feet of Head or PSIG
9) Pump rpm
10) Impeller Diameter in Inches
11) Motor Make and Frame Size
12) Motor Horsepower and rpm
13) Voltage at Each Connection
14) Amperage for Each Phase
15) Full-load Amperage and Service Factor
16) Seal Type

b) Test Data: Include design and actual values for the following:

1) Static Head in Feet of Head or PSIG
2) Pump Shutoff Pressure in Feet of Head or PSIG
3) Actual Iimpeller Size in Inches
4) Full-open Flow Rate in gpm

5) Full-open Pressure in Feet of Head or PSIG
6) Final Discharge Pressure in Feet of Head or PSIG
7) Final Suction Pressure in Feet of Head or PSIG
8) Final Total Pressure in Feet of Head or PSIG
9) Final Water Flow Rate in gpm
10) Voltage at Each Connection
11) Amperage for Each Phase

E. Instrument Calibration:

1) For instrument calibration, include the following:

a) Report Data: Include the following:

1) Instrument Type and Make
2) Serial Number
3) Application
4) Dates of Use

b) Dates of Calibration

3.5 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 09 33
ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Relays and Contactors

2) Transformers

3) Wiring

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Power wiring per Division 26, Electrical.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Drawings: complete control diagram, including written description of control sequences.

2) Operation and Maintenance Manual: Include record wiring drawings showing installed condition and operating changes made during start-up.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Within 30 days prior to warranty expiration date, control supplier to visit job site and check calibration, operation, and adjustment of temperature, pressure and humidity sensors, valves, dampers, thermostats and other devices installed by control supplier. Make repair or replacement of defective control equipment as required at no charge to Owner.

2) Submit letter to Architect certifying that this work has been completed.

3) Attach copy of service report signed by Owner's Authorized Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 RELAYS AND CONTACTORS

A. Provide relays and contactors where required or as shown on Drawing to meet operating sequence where not internal to manufacturer's equipment.

B. Furnish relays or contactors with required coil voltage and contact amperage rating for use specified on Drawing and in manufacturer's equipment.

C. Mount relays in single control cabinet with hinge door and latch.

D. Control cabinet contains relays and numbered terminal strips for connection of relays and field wiring. Mount cabinet on painted plywood panel securely attached to wall framing. Mount time clock, transformer and motor contactors (if required) on plywood adjacent to control panel.

2.3 TRANSFORMERS

A. Transformers selected and sized for appropriate VAC capacity and installed and fused according to applicable codes. Provide wiring to nearest suitable power source as required.

2.4 WIRING

A. In accordance with Division 26, Electrical and applicable codes.

B. Provide line and low voltage wiring relating to control system. Includes wiring of contactors, relays, circuits, and incidental power wiring: operation power for time clock, power when run through stat/timeclock/relay, transformers.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

A.

END OF SECTION

SECTION 23 11 23
FACILITY FUEL - NATURAL GAS PIPING AND SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Steel Pipe and Fittings, Above Grade

2) Natural Gas Valves

3) Natural Gas Pressure Regulators

4) Flexible Pipe Connectors - Gas Piping (CSA Listed)

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Division 26, Electrical requirements for grounding fuel piping systems.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Fittings, Above Grade:

1) American Piping Products

2) US Steel

3) Or approved equivalent.

B. Natural Gas Valves:

1) Apollo

2) Jenkins Bros.

3) Lunkenheimer Co.

4) Nibco

5) Watts

6) Or approved equivalent.

C. Natural Gas Pressure Regulators:

1) Maxitrol

2) Equimeter

3) Or approved equivalent.

D. Flexible Pipe Connectors - Gas Piping (CSA Listed):

1) Dormont

2) Proflex

3) Or approved equivalent.

2.2 STEEL PIPE AND FITTINGS, ABOVE GRADE

A. Steel Pipe (Above Grade Installation):

1) ASTM A53, electric-resistance welded Type E, Grade B black pipe, manufactured for threaded pipe connections.

a) 2-inches and Smaller: Schedule 40, ASTM A53 black steel pipe and black malleable threaded fittings.

b) 2-1/2-inches and Larger: Schedule 40, ASTM A53 black pipe with butt weld fittings.

B. Fittings for Steel Pipe (Above Grade Installations):

1) General: Mark fittings, unions, and other products recognized as regularly available products in accordance with MSS SP-25. Marking on products of small size or shape may be omitted from sequence allowed by MSS SP-25, except for manufacturer's name or trademark.

2) Threaded Fittings: Conforming to ANSI B2.1, ASTM A47, 150 PSI rating, except where otherwise specified or prevailing codes or requirements dictate use of 300 PSI ratings. Fittings to be fabricated from standard malleable iron with dimensions conforming to ANSI B16.3.

3) Unions: Conform to ANSI B16.39, ASTM A47 and fabricated from malleable iron with bronze-to-iron ground joints rated at 150 percent design operating pressure. Threads to conform to ANSI B2.1.

4) Threaded Pipe Plugs: Conforming to ANSI B16.14.

5) Thread Lubricant: Meet or exceed CGA ratings and compliant with Federal Specification TT-S-1732, manufactured compatible with fuel oil.

2.3 NATURAL GAS VALVES

A. 2-inches and Smaller: MSS SP-110 ball valves constructed in compliance with ASME B16.33. UL listed, FM approved, two-piece construction, threaded, bronze or brass body, full port, chrome plated brass ball, blowout-proof stem design, 125 PSI WOG working pressure.

2.4 NATURAL GAS PRESSURE REGULATORS

A. Natural Gas: Diaphragm and spring actuated type, with ventless or vented relief feature. Construction, pressure range and venting features suitable for intended service. Regulator to meet code and serving utility requirements. Pipe vented type to atmosphere in approved location.

2.5 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED)

A. Inner Hose: Type 304 stainless steel.

B. Exterior Sleeve: Braided, Type 304 stainless steel.

C. Pressure Rating: 175 PSI at 70 degrees F up to 4-inch pipe.

D. Joint: Threaded carbon steel.

E. Maximum Offset: 3/4-inch on each side of installed center line.

F. Flexible Connectors: Flexible connectors used in LP and LPG piping systems compliant with following:

1) Install in accordance with manufacturer's instructions.

2) Flexible connectors and hose used as flexible connectors not exceed 3-feet in length where used with liquid or vapor piping on portable or stationary tanks.

3) Hose permitted to be used if flexibility is required for liquid or vapor transfer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Inspection: Examine areas and conditions under which fuel systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Identification: Install mechanical identification.

C. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

D. Remove scale and dirt on inside and outside before assembly.

E. Prepare piping connections to equipment with flanges or unions.

F. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.

G. Install piping systems in accordance with manufacturer's instructions.

H. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

I. Install piping to conserve building space and avoid interference with use of space.

J. Sleeve pipe passing through partitions, walls, and floors.

K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

L. Provide piping mains, branches and runouts installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Provide stresses within allowable limits of ANSI B31.1 for pressure piping.

M. Equipment Connections: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions. Flexible connections where required per ASCE 7-16 or shown on Drawings.

N. Piping Tests: Test natural gas piping in accordance with applicable mechanical code requirements, ANSI B31.2, and local utility requirements at a minimum of 100 psig for 24 hours.

3.2 STEEL PIPE AND FITTINGS, ABOVE GRADE INSTALLATION

A. See 3.1 General Installation Requirements above and install per current version of manufacturer's installation guidelines. Test system in accordance with requirements of local code and ANSI LC-1.

3.3 NATURAL GAS VALVE INSTALLATION

A. Prepare valves for shipping as follows:

1) Protect internal parts against rust and corrosion.

2) Protect threads, flange faces and weld ends.

3) Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1) Maintain valve end protection.

2) Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Do not attempt to repair defective valves; replace with new valves.

D. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated.

E. Locate gas valves where easily accessible and protected from possible damage.

3.4 NATURAL GAS PRESSURE REGULATORS INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and approved submittals.

B. Vent regulators to outdoors as required.

C. Pressure Regulating Valves: Install as required at gas-fired appliances; comply with utility/code requirements. Pipe atmospheric vent to outdoors, full size outlet with 90 degree elbow downturn. Install gas shutoff valve upstream of each pressure regulating valve. Install in accordance with manufacturer's instructions to prevent freezing.

3.5 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED) INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and approved submittals.

END OF SECTION

SECTION 23 21 13
HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Hydronic Piping, Above Grade

2) Unions

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Welding Certificates: Copies of certificates for welding procedures and personnel.

2) Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

a) Test procedures used.

b) Test results that comply with requirements.

c) Failed test results and corrective action taken to achieve requirements.

3) Water Analysis: Submit a copy of the water analysis to illustrate water quality available at project site.

4) Grooved couplings, fittings, valves, and specialties: Show grooved joint couplings and fittings on Shop Drawings and product submittals, and specifically identify with the applicable coupling style number.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Installer Qualifications: Company specializing in performing work of the type specified in this Section, with documented experience.

2) Welder Qualifications: Certify in accordance with ASME (BPV IX).

3) ASME Compliance: Comply with ASME B31.9 "Building Services Piping" for materials, products, and installation. Provide safety valves and pressure vessels with the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 01.

4) Grooved couplings, fittings, valves, and specialties: Provide all grooved couplings, fittings, valves, and specialty products from a single manufacturer. Utilize only grooving

tools from the same manufacturer as the grooved components. Date-stamp all castings used for couplings housings, fittings, or valve and specialty bodies for quality assurance and traceability.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 HYDRONIC PIPING, ABOVE GRADE

A. Grooved Mechanical Joint Fittings for Condenser Water Only: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47 (ASTM A47M), Grade 32510 malleable iron; ASTM A53, Type F, E, or S, Grade B fabricated steel; or, ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.

1) Grooved Mechanical-Joint Couplings: Ductile or malleable iron housing and synthetic rubber gasket of central cavity pressure-responsive design for operating temperature range from -30 degrees F to 230 degrees F. Gasket material as recommended by manufacturer for design conditions.

a) Manufacturers - Grooved Mechanical Joint Fittings and Couplings:

1) Anvil International
2) Shurjoint Piping Products
3) Victaulic

B. Grooved Mechanical Joint Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47 (ASTM A47M), Grade 32510 malleable iron; ASTM A53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.

1) Manufacturers - Grooved Mechanical Joint Fittings and Couplings:

a) Victaulic.

b) Or approved equivalent.

2) Grooved Mechanical-Joint Couplings: Ductile Iron housing conforming to ATSM A536 with angled bolt pads and Grade EHP gasket with temperature range from -30 degrees F to 250 degrees F. 2-inch to 12-inch Victaulic Style 177N and 107N. 14-inch and larger - AGS two-segment couplings, with wide-width FlushSeal gasket and lead-in chamfer on housing key. Basis of Design: Victaulic Style W07 (rigid) and Style W77 (flexible).

3) The grooved product manufacturer is to provide a visual (external) examination of the installed joints and confirmation of bolt/nut torque using a torque wrench as specified in the manufacturer's installation handbooks. Document and provide a written report by the factory representative stating compliance or noncompliance of all of the manufacturer's requirements and locations of limited or no pipe joint accessibility preventing examination, for acceptance by the owner. Obtain approval from the Architect prior to concealing any grooved joint.

C. Steel Pipe:

1) Sizes 10-inches and Under: ASTM A 53/A 53M, Schedule 40, black, Type E (electric resistance welded), Grade B.

a) Fittings: ASME B16.3, malleable iron or ASTM A 234/A 234M, wrought steel welding type.

b) Wrought Cast and Forged Steel Flanges and Flanged Fittings: ASME B16.5 including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1) Material Group: 1.1.
2) End Connections: Butt welding.
3) Facings: Raised face.

c) Joints: Threaded or AWS D1.1 welded.

D. Copper Tube: ASTM B 88 (ASTM B 88M), Type L, hard drawn.

1) Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.

2) Joints: Solder, lead free ASTM B32, HB alloy (95-5 tin antimony), or tin and silver.

2.2 UNIONS

A. Unions for Pipe 2-inches and Under:

1) Ferrous Piping: 150, 250, and 300 PSIG malleable iron, threaded, ASME B16.39.

2) Copper Pipe: Bronze, soldered joints, ASME B16.22.

B. Dielectric Connections: Provide dielectric waterway or brass nipple fitting with threaded ends. Dielectric unions are not allowed.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written instructions and requirements.

B. Install hydronic piping in accordance with the following:

	Above Grade		
Service	W/S	GC	Cu
Condenser Water	X	X	X

1) Key:

a) W/S = Welded/Screwed Steel

b) GC = Grooved Coupling Steel

c) Cu = Copper

C. Preparation:

1) Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

2) Remove scale and dirt on inside and outside before assembly.

3) Prepare piping connections to equipment with flanges or unions.

4) Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

D. Above Grade Piping Installation:

1) Install per manufacturer's written instructions and requirements.

2) Install heating water, glycol, condenser water, piping to ASME B31.9 requirements. Install chilled water piping to ASME B31.5 requirements.

3) Route piping in orderly manner, parallel to building structure, and maintain gradient.
4) Install piping to conserve building space and to avoid interference with use of space.
5) Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
6) Sleeve pipe passing through partitions, walls and floors allowing adequate space for pipe insulation.
7) Slope piping at 0.2 percent upward in direction of flow and arrange to drain at low points.
8) Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
9) Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
10) Drawings are diagrammatic and do not necessarily show top connections in all cases. Install branch connections to mains using tee fittings in main, with takeoff coming out of the top unless trade coordination conditions preclude it.
11) Anchor piping for proper direction of expansion and contraction.
12) Inserts:
    a) Provide inserts for placement in concrete formwork.
    b) Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
    c) Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.
    d) Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
    e) Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
13) Pipe Hangers and Supports:
    a) Install in accordance with Division 23, HVAC, Hangers and Supports.
    b) Install hangers to provide minimum1/2-inch space between finished covering and adjacent work.
    c) Place hangers within 12-inches of each horizontal elbow.
    d) Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
    e) Support vertical piping at top, bottom, and not less than every other floor. Support riser piping independently of connected horizontal piping.
    f) Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
    g) Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
    h) Provide copper plated hangers and supports for copper piping.

i) Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

14) Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

15) Provide access where valves and fittings are not exposed.

16) Use eccentric reducers to maintain top of pipe level.

17) Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

18) Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

E. Field Quality Control:

1) Leave joints, including welds, uninsulated and exposed for examination during test.

2) Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3) Flush system with clean water. Clean strainers.

4) Isolate equipment from piping. If a valve is used to isolate equipment, provide closure capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5) Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

6) Perform the following tests on hydronic piping:

a) Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

b) While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.

c) Check expansion tanks to determine that they are not air bound and that system is full of water.

d) Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure not-to-exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."

e) After hydrostatic test pressure has been applied for at least four hours, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

f) Prepare written report of testing.

F. Flushing and Cleaning of Piping Systems:

1) Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide temporary connections for cleaning, purging, and circulating fluids through the piping system.

2) Use temporary strainers and temporary pumps that can create a minimum fluid velocity of 6-feet per second and maximum of 10-feet per second to flush and clean the piping systems. Do not use Owner's permanent strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.

3) When constructing minor piping modifications or additions, verify with Owner if the Owner's pumps and strainers can be used for flushing and chemical cleaning operations. When the flushing and cleaning operations are complete, ensure the strainer baskets and screens installed in the piping systems permanent strainers are replaced with clean elements. Keep temporary strainers in service until the equipment has been tested, then replace straining element with a new strainer and clean and deliver the old straining elements to Owner. Fit the Owner's strainers with a line size blowoff valve.

4) Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps, and cooling coils, etc., to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.

5) Circulate a chemical cleaner in condenser water piping systems to remove mill scale, grease, oil, and silt. Cleaner to be selected by chemical treatment vendor on project. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The condenser water system should then be treated with chemicals and inhibitors to be selected by chemical treatment vendor on project. When the chemical cleaning is complete, remove, clean, and reinstall all permanent screens. Notify Owner so that the reinstallation of clean strainer screens may be witnessed.

G. Pipe Painting Requirements:

1) Paint all ferrous metal pipe including flanges. Do not paint flange bolts, washers and nuts. At flexible coupling the only the flanges are to be painted. All rubber portions are to remain unpainted.

2) Paint exterior uninsulated steel piping with exterior latex, semi-gloss (AE), Master Painters Institute MPI 11, suitable for metallic surfaces B, Haze Gray color.

3) Use ready-mixed (including colors) paint. Prime paint with pigment and vehicle, compatible with substrate and finish coats specified. Volatile Organic Compounds (VOC) content of paint materials shall not exceed 50g/l for exterior latex paints and primers. Lead-based paint is not permitted.

4) Do not apply coating when air or substrate conditions are:

a) Less than 5 degrees F above dew point.

b) Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the product manufacturer.

5) Do no exterior painting when it is windy and dusty. Do not paint in direct sunlight or on surfaces that the sun will soon warm.

6) Apply only on clean, dry and frost-free surface. Remove all materials the will affect the ability of the paint to adhere to the pipe including painted pipe identification labels.

7) Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign. Remove loose mill scale, rust, and paint, by hand or power tool cleaning. All surfaces are to be dry at the time paint is applied.

8) Apply paint in two coats; prime, and finish. Apply each coat evenly and cover substrate completely. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions.

9) Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects. Apply by brush, roller or spray.

END OF SECTION

SECTION 23 21 16
HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Air Vents
2) Pressure Reducing Valves
3) Liquid Flow Switches
4) Instrument Probe Fittings
5) Strainers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 01 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
2) Certificates: Inspection certificates for pressure vessels from Authority Having Jurisdiction (AHJ).
3) Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
4) Project Record Documents: Record actual locations of flow controls.
    a) Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum three years of documented experience.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Air Vents:
   1) Armstrong International, Inc.
   2) ITT Bell & Gossett
   3) Taco, Inc.
   4) Hoffman
   5) Amtrol
   6) Metraflex

B. Pressure Reducing Valves:
   1) Armstrong
   2) ITT Bell & Gossett
   3) Taco, Inc.
   4) Amtrol
   5) Kunkle

C. Liquid Flow Switches:
   1) McDonnell & Miller
   2) Dwyer
   3) Or approved equivalent.

D. Instrument Probe Fittings:
   1) Pete's Plug
   2) Or approved equivalent.

E. Strainers:
   1) Armstrong International
   2) Mueller
   3) Keckley
   4) Hoffman

2.2 AIR VENTS

A. Manual Type: Short vertical sections of pipe to form air chamber, with 1/8-inch brass needle valve at top of chamber.

B. Automatic Float Type: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, drain connection, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.3 PRESSURE REDUCING VALVES

A. Brass body, adjustable range, inlet check valves, removable inlet strainer, noncorrosive valve seat and stem, 3/4-inch size unless otherwise shown, factory set at fill pressure as indicated on drawings.

2.4 LIQUID FLOW SWITCHES

A. Description: Brass for wetted parts with packless construction, paddle with removable segments for pipe size and flow velocity, vapor proof electrical compartment for switches mounted on cold hydronic piping systems, switches for 115V, 60 Hz, 1-phase with 7.4A rating.

2.5 INSTRUMENT PROBE FITTINGS

A. Brass or stainless steel body and cap, high pressure rated, valve material neoprene, Nordal or Viton to suit temperature range, 1/4-inch or 1/2-inch NPT tailpiece.

2.6 STRAINERS

A. Size 2-inches and Under: Screwed brass or iron body for 175 PSI working pressure, Y pattern with 1/16-inch stainless steel perforated screen.

B. Size 2-1/2-inches and Larger: Flanged or grooved and above: iron body for 175 PSI working pressure, Y pattern with 1/16 stainless steel perforated screen.

C. Basket Pattern: Flanged iron body for 175 PSI working pressure, basket pattern with 1/8-inch stainless steel perforated screen, clamped or bolted cover.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install specialties in accordance with manufacturer's instructions.

B. Support pump fittings with floor mounted pipe and flange supports. Provide vibration isolation, same as pump, to avoid short circuiting.

3.2 AIR VENTS

A. Where large air quantities can accumulate, provide enlarged air collection standpipes.

B. Automatic: Furnish and install automatic air vents in mechanical equipment rooms and outdoors only. Install at high points of system piping, at heat transfer coils, and elsewhere as required for system air venting. Vents: 3/4-inch with 1/2-inch IPS drain piping to the nearest floor drain or other approved location. Provide a ball valve and union ahead of all automatic air vents. Do not install above ceilings or locations where discharge may occur and cause damage.

C. Manual Vents: Provide at high points of system piping, at heat transfer coils, and elsewhere as required for system venting where automatic air vents are not to be installed. Provide 10-inch length of 1/4-inch copper tube with 180 degree bend down to discharge into hand-held bucket.

3.3 PRESSURE REDUCING VALVES

A. Install as indicated, and in accordance with manufacturer's instructions with three valve bypass.

3.4 LIQUID FLOW SWITCHES

A. Install on inlet to water chiller and on other equipment as indicated. Install in horizontal pipe with switch mounted in tee on top of pipe with minimum of 24 inches of straight pipe with no fitting both upstream and downstream of switch. Remove segments of paddle to fit in accordance with manufacturer's instructions.

3.5 INSTRUMENT PROBE FITTINGS

A. Test Plugs: Install where indicated and in accordance with the manufacturer's recommendations.

3.6 STRAINERS

A. Provide valved drain and hose connection on strainer blow down connection.

END OF SECTION

SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Chemicals

2) Supplemental Services/Components

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Product Data: Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:

a) Chemicals

b) Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

c) Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

d) Maintenance Data: For pumps, agitators, filters, system controls, and accessories to include in maintenance manuals specified in Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Qualifications: Firms regularly engaged in manufacture of components of types and sizes required.

2) Installer Qualifications: An experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project.

3) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

B. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction. Consult equipment manufacturer prior to acceptance of values noted below.

1) Small, Open Systems for Cooling Towers smaller than 50 tons: Maintain system essentially free of scale, total suspended solids, and fouling to sustain the following water characteristics:

a) pH: Maintain a value within 8.0 to 9.1.

b) "P" Alkalinity: Maintain a maximum value of 100 ppm.

c) Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.

d) Soluble Copper: Maintain a maximum value of 0.20 ppm.

e) TDS: Maintain a maximum value of 10 ppm.

f) Ammonia: Maintain a maximum value of 20 ppm.

g) Free "OH" Alkalinity: Maintain a maximum value of 0 ppm.

h) Microbiological Limits:

1) Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.
2) Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

i) Polymer Testable: Maintain a minimum value within 10 to 40.

2) Passivation for Galvanized Steel (for the first 60 days of operation):

a) pH: Maintain a value within 7 to 8.

b) Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.

c) Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

1.8 MAINTENANCE

A. Scope of Service: Provide chemicals and service program for maintaining optimum conditions in the circulating water for inhibiting corrosion, scale, and organic growths in the condenser water piping and equipment. Services and chemicals provided for a period of one year from date of Substantial Completion, including the following:

1) Initial water analysis and recommendations.

2) Startup assistance.

3) Periodic field service and consultation.

4) Customer report charts and log sheets.

5) Laboratory technical assistance.

6) Analyses and reports of chemical items concerning safety and compliance with government regulations.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1) Chemicals: Furnish quantity equal to 50 percent of amount initially installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Aqua-Chem, Inc.; Cleaver-Brooks Div.

B. Betz Dearborn, Inc.

C. Calgon Corp., ECC International

D. ITOH2 Industrial Treatment of Water

E. Nalco Chemical Co.

F. US Water Services

G. Chemcoa

H. Cleaver-Brooks

I. Sarco

J. Or approved equivalent.

2.2 CHEMICALS

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

C. Biocide: Chlorine release agents or microbiocides.

D. Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

E. Open-Loop Piping Chemicals Serving Small Cooling Towers: Sequestering agent to inhibit scaling, corrosion inhibitor, and biocide nonoxidizing.

2.3 SUPPLEMENTAL COMPONENTS/SERVICES

A. Drain and makeup water piping to comply with the requirements of Division 22, Plumbing. Drains which connect to sanitary sewer systems to be connected by means of an indirect waste.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Water Analysis:

1) Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

2) Existing Systems:

a) Prior to filling new hydronic distribution systems, verify existing chemical treatment system is adequate for installed system pipe longevity.

B. Installation:

1) Install treatment equipment level and plumb. Provide power to all system devices.

2) Add cleaning chemicals as recommended by manufacturer.

3) To prevent dirt and solids from lodging the coils, before adding cleaning chemical to the closed system, air handling coils and fan coil units to be isolated by closing the inlet and outlet valves and opening the bypass valves Do not valve in or operate system pumps until after system has been cleaned.

4) After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the by-pass valves. Also, clean strainers.

C. Connections:

1) Piping installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

2) Provide a by-pass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.

3) Bleed off water piping with bleed off piping assembly to be piped from pressure side of circulating water piping to a convenient drain. Bleed off connection to main circulating water piping to be upstream of chemical injection nozzles.

4) Provide piping for the flow assembly piping to the main control panel and accessories.

a) The inlet piping to connect to the discharge side of the circulating water pump.

b) Piping to connect to the water piping service the cooling tower downstream of the heat source.

c) Provide inlet Y-strainer and ball valves to isolate and service main control panel and accessories.

d) Install injection nozzles with corporation stops in the water piping service the cooling tower downstream of the heat source.

e) Provide piping for corrosion monitor rack per manufacturers installation instructions. Provide ball valves to isolate and service rack.

f) Provide piping for erosion chemical feeder per manufacturer's installation instructions. Provide ball valves to isolate and service feeder.

5) Install piping adjacent to equipment to allow service and maintenance.

6) Confirm applicable electrical requirements in Division 26, Electrical Sections for connecting electrical equipment.

7) Ground equipment.

a) Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Field Quality Control:

1) Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

   a) Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.

   b) Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

2) Test chemical feed piping as follows:

   a) Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.

   b) Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

   c) Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.

   d) Cap and subject piping to static water pressure of 50 PSIG (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.

   e) Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.

   f) Prepare test reports, including required corrective action.

E. Adjusting:

1) Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare certified test report for each required water performance characteristic. Where applicable, comply with ASTM D 3370 and the following standards:

   a) Silica: ASTM D 859.

   b) Steam System: ASTM D 1066.

   c) Acidity and Alkalinity: ASTM D 1067.

   d) Iron: ASTM D 1068.

   e) Water Hardness: ASTM D 1126.

2) Occupancy Adjustments: Within 12 months of Substantial Completion, perform two separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 days apart. Submit written reports of water analysis.

F. Gauge Adjusting and Cleaning:

1) Adjust faces of meters and gauges to proper angle for best visibility.

2) Clean windows of meters and gauges and factory finished surfaces. Replace cracked or broken windows, repair scratched or marred surfaces with manufacturer's touch-up paint.

G. Demonstration:

1) Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
    a) Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2) Review manufacturer's safety data sheets for handling of chemicals.
3) Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.
4) Schedule at least four hours of training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Louvers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.

2) Performance Data: Include static-pressure drop.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23, HVAC sections, where more than a single type is specified for the application, provide single selection for each product category.

B. Louvers:

1) Ruskin Manufacturing

2) Pottorff

3) Carnes

4) Cesco

5) Greenheck

6) Or approved equivalent.

2.2 LOUVERS

A. General: Frame and sill styles compatible with adjacent substrate, specifically manufactured to fit into construction openings with accurate fit and adequate support for weatherproof installation. Reference Drawings and Specifications for types of substrate which will contain each type of louver. Construct of aluminum extrusions, ASTM B221, Alloy 6063-T5. Weld units or use stainless steel fasteners. On inside face of exterior louvers, provide anodized aluminum wire bird screen mounted in removable extruded aluminum frames. AMCA licensed performance ratings.

B. Blades set 3 to 5-inches on center, 37.5 degree angle with rain hook on blade, minimum blade thickness 0.080-inch, drainable blade style. Minimum 57 percent free area for 48-by 48-inch unit. Maximum water penetration 0.01 ounce water psf free area at 1000 FPM. Maximum intake pressure drop of 0.10-inch wg at 750 FPM free velocity. Provide downspouts in jambs, designed to drain water from louver for minimum water cascade from blade to blade. Provide drain gutter in head frame and each blade.

C. Reference Drawings for free area required.

D. Finish: Factory prime coat finish. Conform to AAMA 605.2. Apply coating following cleaning, and pretreatment. Dry louvers before final finish application. 1.2 mils total dry film thickness when baked at 450 degrees F for ten minutes.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install in accordance with manufacturer's instructions. Provide seismic supports, clips, and bracing per local code. Coordinate installation of framing. Provide complete coverage of rough openings by integral device flanges or auxiliary frames. Provide frame to match wall surrounding exterior louvers.

END OF SECTION

SECTION 23 51 00
BREECHINGS, CHIMNEYS AND STACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Gas-Fired Equipment Vents

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) ASTM C 401 - Standard Classification of Alumina and Alumina-Silicate Castable Refractories, current edition.

2) NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; National Fire Protection Association, current edition.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

2) Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations.

3) Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

4) Submit venting system design and calculations.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

A. Breeching: Vent connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Smoke Pipe: Round, single wall vent connector.

D. Vent: That portion of venting system designed to convey flue gases directly outdoors from vent connector or from an appliance when vent connector is not used.

E. Vent Connector: That part of venting system that conducts flue gases from flue collar of an appliance to chimney or vent, and may include draft control device.

1.8 DESIGN REQUIREMENTS

A. Factory built vents and chimneys used for venting natural draft appliances comply with NFPA 211 and be UL listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Gas-Fired Equipment Vents:

1) Gravity Vent Systems:

a) AMPRO by Hart & Cooley

b) Ecco Manufacturing

c) Industrial Chimney Company

d) Selkirk Corporation

e) Security Chimney/DuraVent

2.2 GAS-FIRED EQUIPMENT VENTS

A. Gravity Vent Systems:

1) Type "B" factory fabricated, UL listed, doublewall flue, with aluminum inner wall, galvanized steel outer wall and 1/2-inch air space between unless noted otherwise. Provide twist-lock connectors, tall cone flashing, storm collar, and round birdproof/weatherproof top.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's written instructions and guidelines.

B. Install in accordance with NFPA 54.

3.2 GAS-FIRED EQUIPMENT VENTS

A. General: Vent-type to match equipment manufacturer requirements: Category 1 or Category 4. Maintain clearances to combustible materials per code; double-wall, insulation, thimbles, etc. at reduced clearance locations as necessary. Vent termination clearances from buildings, building openings, ventilation intakes, etc. per code.

B. Atmospheric Gas-Fired Vents:

1) Install venting in accordance with the manufacturer's recommendations and the requirements of the UL listing of the system.

2) Extend venting to 2 feet minimum above the roof. Maintain clearances from other buildings, openings, intakes, etc. per code unless otherwise indicated. Provide guy wire supports for vents terminating 6 feet or higher above the roof.

END OF SECTION

SECTION 23 65 00
COOLING TOWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Forced Draft Cooling Towers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.

2) ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.

3) AHRI 575 - Method of Measuring Machinery Sound Within an Equipment Space

4) ASME PTC 23 - Atmospheric Water-Cooling Equipment; The American Society of Mechanical Engineers

5) CTI ATC-105 - Acceptance Test Code; Cooling Technology Institute

6) CTI STD ATC-105S Acceptance Test Code for Closed Circuit Coolers

7) CTI ATC-128 - Measurement and Evaluation of Sound from Water Cooling Tower; Cooling Technology Institute

8) CTI STD 151 - VFD Application for Cooling Towers

9) CTI STD-201 - Certification Standard for Commercial Water Cooling Towers; Cooling Technology Institute

10) NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association

11) NFPA 70

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.

2) Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.

3) Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

4) Manufacturer's Certificate: Certify that cooling tower performance, based on CTI ATC-105, CTI STD-201, or ASME PTC 23 meet or exceed specified requirements and submit performance curve plotting leaving water temperature against wet bulb temperature.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Provide a five year warranty on stainless steel towers to include coverage for corrosion resistance of cooling tower structure, cooling tower package, fan drive, and motor parts only. Standard galvanized tower one year from start-up or 18 months from shipment, whichever occurs first.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Baltimore Aircoil Company

B. EVAPCO, Inc.

C. SPX Cooling Technologies/Marley

2.2 FORCED DRAFT COOLING TOWERS

A. Manufactured Units: Factory assembled mechanical blow-through type, arranged for outdoor use, horizontal air flow, counterflow, fan, motor and drive, variable speed drive, vibration isolation, eliminators, spray system, water make-up valve, all contained in unitized casing.

B. Casing: Galvanized steel panels; galvanized steel angle framework.

C. Collection Basin: Basin of Type 304 stainless steel, shaped to provide self-cleaning action. Outlet with suction screen; clean out connections; suitable for sump heater.

D. Distribution Section: Polyvinyl chloride piping header and branches with ABS plastic spray nozzles.

E. Fill: Self-supporting fluted polyvinyl chloride plastic with ASTM E 84 flame spread index of 5 or less.

F. Drift eliminators: Two or three pass PVC or hot dipped galvanized steel drift loss limited to 0.002 percent of total water circulated.

G. Fans: Multi-blade, cast aluminum, axial type. Belt drive, bearings with ABMA STD 9 or ABMA STD 11 L-10 life at 30,000 hours, with extended grease fittings. Belt drive designed for 150 percent motor nameplate power.

H. Motor: Totally enclosed, fan cooled type, single speed (1800 rpm, premium efficient type) mounted on adjustable steel base, suitable for VFD.

I. Accessories:

1) Float Valves: Brass or bronze balanced piston type make-up valve with copper float. PVC valves are not acceptable.

2) Electronic Water Level Control: Multiple stainless steel probes mounted internal to unit in vertical pipe. Provide contacts for make-up water valve open/close operation and high and low water level alarms. Provide slow closing solenoid valve on make-up water connection.

3) Electric Immersion Heaters: In collection basin; suitable to maintain temperature of water in basin at 42 degrees F when outside temperature is 0 degrees F and wind velocity is 15 mph; immersion thermostat and low level control to operate heaters on low temperature

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's instructions.

B. Install tower on structural steel beams as instructed by manufacturer.

C. Install tower on vibration isolators. Reference Division 23, HVAC, Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Connect condenser water piping with flanged or grooved connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower.

E. Connect make-up water piping with flanged or union connections to tower. Pitch to tower.

F. Connect to water treatment system.

G. Inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

H. Supervise rigging, hoisting, and installation.

I. Start-up tower in presence of and instruct Owner's operating personnel.

J. Test for capacity under actual operating conditions in accordance with CTI ATC-105, and verify specified performance.

3.2 FORCED DRAFT COOLING TOWERS INSTALLATION

A. Connect to sidestream separator.

B. Connect to sand filter system.

C. Connect and provide equalizer line piping (sized by cooling tower manufacturer.)

END OF SECTION

SECTION 23 82 00
TERMINAL HEAT TRANSFER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Electric Wall Heaters

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 ELECTRIC WALL HEATERS

A. Manufacturers:

1) Trane
2) Markel
3) Qmark
4) Chromalox
5) Indeeco

B. Description: Wall mounted forced air unit heater, including enclosure for surface mounting, fan and motor, heating elements and wall box. UL listed and wired per NEC.

C. Cabinet: 20 gauge zinc coated steel, 16 gauge painted exterior grille.

D. Fan and Motor: Propeller type fan, totally enclosed motor with permanently lubricated bearings and thermal overload protection, vandal proof.

E. Heating Element: Sealed tubular type with finned heating elements, manual reset thermal limit safety switch, fan purge limit to dissipate residual heat on heater shutdown.

F. Control:

1) Built-in thermostat with accessible disconnect switch.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways. Check each piece of equipment for defects, verifying that items function properly and that adjustments have been made.

B. Prior to acceptance, thoroughly clean exposed portions of terminal heat transfer equipment, remove shipping labels and traces of foreign substance. Touch up scratched surfaces of radiant panels with factory matching paint.

3.2 ELECTRIC WALL HEATERS INSTALLATION

A. Damaged Coils: Make every effort to prevent damage to both built-up coils and coils of packaged equipment. Comb damaged coil fins to be straight.

B. Install per manufacturer's instructions. Comply with NEC and UL listings.

C. Install heaters in place with box trim flush with finished wall.

END OF SECTION

SECTION 26 00 00
ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1) Provide: To furnish and install, complete and ready for intended use.

2) Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.

3) Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.

4) Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.

5) Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 26, Electrical Contract Documents.

B. Related Work:

1) Additional conditions apply to this Division including, but not limited to:

a) Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

b) Drawings

c) Addenda

d) Owner/Architect Agreement

e) Owner/Contractor Agreement

f) Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 26, Electrical Sections and those

listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1) State of Washington:

a) IBC - International Building Code

b) IFC - International Fire Code

c) IMC - International Mechanical Code

d) NEC - National Electrical Code

e) UPC - Uniform Plumbing Code

f) WAC - Washington Administrative Code

g) WSEC - Washington State Energy Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1) ABA - Architectural Barriers Act
2) ADA - Americans with Disabilities Act
3) ANSI - American National Standards Institute
4) APWA - American Public Works Association
5) ASCE - American Society of Civil Engineers
6) ASHRAE Guideline 0, the Commissioning Process
7) ASTM - ASTM International
8) CFR - Code of Federal Regulations
9) EPA - Environmental Protection Agency
10) ETL - Electrical Testing Laboratories
11) FCC - Federal Communications Commission
12) FM - FM Global
13) IBC - International Building Code
14) IEC - International Electrotechnical Commission
15) IEEE - Institute of Electrical and Electronics Engineers
16) IES - Illuminating Engineering Society
17) ISO - International Organization for Standardization
18) MSS - Manufacturers Standardization Society
19) NEC - National Electric Code
20) NECA - National Electrical Contractors Association
21) NEMA - National Electrical Manufacturers Association
22) NETA - National Electrical Testing Association
23) NFPA - National Fire Protection Association

24) OSHA - Occupational Safety and Health Administration

25) UL - Underwriters Laboratories Inc.

D. See Division 26, Electrical individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1) "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2) Provide product submittals and shop drawings in electronic format only. Electronic format must be posted to ftp site. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.

a) Provide separate submittals for lighting control cutsheets, and for lighting control shop drawings.

3) Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.

4) Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

a) Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

b) Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.

c) See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.

5) Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to

contractor without review.

6) Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7) Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8) Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals. Electric motors are supplied and installed by Division 23 unless otherwise specified. During shop drawing stage of the project, verify correct disconnect sizes, conductor sizes, etc., and bring any discrepancies to the attention of the Mechanical trade. Be responsible for any modifications to electrical equipment or installations as a result of equipment incompatibility discovered after shop drawing review.

9) Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10) Substitutions and Variation from Basis of Design:

    a) The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

    b) If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11) Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.

    a) Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12) Samples: Provide samples when requested by individual Sections.

13) Resubmission Requirements:

    a) Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's

submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.

b) Resubmit for review until review indicates no exception taken or "make corrections as noted".

14) Operation and Maintenance Manuals, Owner's Instructions:

a) Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
3) Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
4) Include product certificates of warranties and guarantees.
5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
6) Include commissioning reports.
7) Include copy of startup and test reports specific to each piece of equipment.
8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b) Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.

c) Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15) Record Drawings:

a) Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b) Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.

c) At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD Files and drawings upon substantial completion.

d) At completion of project, show changes and deviations from the Drawings in red on one set of black-line drawings. Include written Addendums, RFIs, and change order items. Make changes to Drawings in a neat, clean, and legible manner.

e) See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

C. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1) Comply with local, State of Washington, and Federal regulations relating to hazardous materials.

2) Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3) Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

2.3 ACCESS PANELS

A. See Division 01, General Requirements and Division 08, Openings for products and installation requirements.

B. Confirm Access Panel requirements in Division 01, General Requirements, Division 08, Openings and individual Division 26, Electrical Sections. In the absence of specific requirements, comply with the following:

1) Provide flush mounting access panels for service of systems and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.

a) Ceiling access panels to be minimum of 24-inch by 24-inch.

b) Wall access panels to be minimum of 12-inch by 12-inch.

c) Provide screwdriver operated catch.

d) Manufacturers and Models:

1) Drywall: Karp KDW.
2) Plaster: Karp DSC-214PL.
3) Masonry: Karp DSC-214M.
4) 2 hour rated: Karp KPF-350FR.
5) Manufacturers: Milcor, Elmdor, Acudor, or approved equivalent.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1) Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

a) Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.

b) Excavation: Do not excavate under footings, foundation bases, or retaining walls.

c) Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1) Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

a) Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums:

1) In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.

B. General:

1) Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.

2) Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

3) Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.

4) Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.

5) Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Notify Architect or Engineer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1) Underground conduit installation prior to backfilling.

2) Prior to covering walls.

3) Prior to ceiling cover/installation.

4) When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1) Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.

2) Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements, and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1) During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is

installed.

2) Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.

3) Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.

   a) If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.

4) No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.

   a) Organize work to minimize duration of power interruption.

   b) Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

   1) Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).

   2) Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.

   3) Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.

   4) Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

   5) Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1) Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.

2) Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3) Protect bus duct and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.

B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

3.9 CLEANING

A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Install equipment and fixtures in accordance with manufacturers' installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1) Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for

hot surfaces.

2) In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.

3) See individual equipment Specifications for other painting.

4) Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5) Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.

6) Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCESS PANELS

A. Confirm Access Panel requirements in Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1) Coordinate locations/sizes of access panels with Architect prior to work.

3.13 DEMOLITION

A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1) It is the intent of these documents to provide necessary information and adjustments to electrical system required to meet code, and accommodate installation of new work.

2) Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas. Owner will cooperate to best of their ability to assist in coordinated schedule, but will remain final authority as to time of work permitted.

3) Examination:

a) Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to locate and preserve utilities. Replace damaged items with new material to match existing.

b) Verify that abandoned wiring and equipment serve only abandoned facilities.

c) Demolition drawings are based on casual field observation and existing record documents.

1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.
2) Verify location and number of electrical outlets, luminaires, panels, etc. in field.

d) Report discrepancies to Architect before disturbing existing installation.

1) Promptly notify Owner if utilities are found which are not shown on Drawings.

4) Execution:

a) Remove existing luminaires, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.

b) Provide temporary wiring and connections to maintain electrical continuity of existing systems during construction. Remove or relocate electrical boxes, conduit, wiring, equipment, and luminaires, as encountered in removed or remodeled areas in existing construction affected by this work.

c) Remove and restore wiring which serves usable existing outlets clear of construction or demolition.

d) If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass inaccessible junction boxes and abandoned outlets.

e) If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of construction or demolition and maintain service to existing load.

f) Extend circuiting and devices in existing walls to be furred out.

g) Remove abandoned wiring to source of supply.

h) Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

i) Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

j) Disconnect and remove abandoned panelboards and distribution equipment.

k) Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

l) Existing lighting which is to remain, leave luminaires in proper working order.

m) Repair adjacent construction and finishes damaged during demolition work.

n) Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

3.14 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1) System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a) Cleaning

b) Operation and Maintenance Manuals

c) Training of Operating Personnel

d) Record Drawings

e) Warranty and Guaranty Certificates

f) Start-up/Test Document and Commissioning Reports

3.15 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Tests:

1) Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.

2) During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.16 SALVAGED EQUIPMENT AND RECYCLED MATERIAL

A. Salvage the following equipment not being reused and return to Owner:

1) Luminaires

2) Panelboards

3) Breakers

4) Transformers

B. Electrical equipment that cannot be salvaged for reuse, sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:

1) Copper or aluminum conductors, buses, and motor/transformer windings.

2) Steel and aluminum from raceways, boxes, enclosures, and housings.

3) Acrylic and glass from luminaire lenses/refractors.

C. Provide separate on-site storage space for recycled and salvaged material. Clearly label space.

D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

END OF SECTION

SECTION 26 05 09
EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Equipment connections, whether furnished by Owner or other Divisions of the Contract.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition:

1) Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

2.2 GENERAL

A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:

1) 3/4 HP and Under: 120 volt, 1 phase.

2) 1 HP and Less than 5 HP Loads: 208 volt, 3 phase.

3) 5 HP and Over: 208 volt, 3 phase.

B. Safety Switches: Provide as required by NEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:

1) Division 8, Openings

2) Division 11, Equipment

3) Division 22, Plumbing

4) Division 23, HVAC, Heating, Ventilating and Air Conditioning

3.2 INSTALLATION

A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Engineer.

B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.

C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.

D. Install motor starters and controllers for equipment furnished by others.

E. Appliance/Utilization Equipment:

1) Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.

2) Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Division 01, General Requirements.

3.4 SYSTEMS STARTUP

A. Provide field representative to prepare and start equipment.

1) Test and correct for proper rotation of polyphase motors.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner's Authorized Representative.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1) Lugs and Pads
   2) Wires and Cables
   3) Connectors

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:
   1) Cable insulation test reports in project closeout documentation.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lugs and Pads:
   1) Anderson
   2) Ilsco
   3) Panduit
   4) Thomas & Betts
   5) 3M
   6) Or approved equivalent.

B. Wires and Cables:
   1) General:
      a) General Cable

b) Okonite

c) Southwire

d) Encore Wire

e) Or approved equivalent.

2) Metal Clad Cable - Type MC:

a) Alflex

b) AFC

c) General Cable

d) Southwire

e) Encore Wire

f) Or approved equivalent.

C. Connectors:

1) Anderson Power Products
2) Burndy
3) Ilsco
4) 3M
5) Thomas & Betts
6) Or approved equivalent.

2.2 LUGS AND PADS

A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

B. Copper Pads: Drilled and tapped for multiple conductor terminals.

C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical type for use with solid branch and feeder circuit conductors.

2.3 WIRES AND CABLES

A. Building Wires:

1) Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid or stranded. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2.

B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.

C. Color Code Conductors as Follows:

PHASE	208 VOLT WYE	240 VOLT DELTA	480 VOLT
A	Black	Black	Brown
B	Red	Orange (High Leg)	Orange
C	Blue	Blue	Yellow

Neutral	White	White	Gray or White w/colored strip
Ground	Green	Green	Green
Isolated Ground	Green w/yellow trace	N/A	N/A

D. MC Cable:

1) Standard: High strength galvanized steel flexible armor. Full length minimum size No. 12 copper ground wire, copper dual rated THHN/THWN-2, full length tape marker phase/circuit identification on cable armor. Short circuit throat insulators, mechanical compression termination.

E. AC Cable (Armored Cable): Not allowed.

F. NMB Cable: Not allowed.

2.4 CONNECTORS

A. Split bolt connectors not allowed.

B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer instructions and NEC.

B. Field Quality Control:

1) Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.

2) Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.

3) Inspect and test in accordance with NETA Standard ATS, except Section 4.

4) Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.2 LUGS AND PADS

A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.

B. Use torque wrench to tighten per manufacturer's directions.

3.3 WIRES AND CABLES

A. General:

1) Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F). All wire and cable must be acclimated to temperatures above freezing for no less than 24 hours prior to installation.

2) Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.

3) Install conductors with care to avoid damage to insulation.

4) Do not apply greater tension on conductors than recommended by manufacturer during installation.

5) Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.

6) Conductor Size and Quantity:

a) Install no conductors smaller than 12 AWG unless otherwise shown.

b) Provide required conductors for a fully operable system.

c) Power Circuits: No. 12 AWG minimum, except as follows:

1) No. 10 AWG for 15A, 120V circuits longer than 100 ft.
2) No. 8 AWG for 15A, 120V circuits longer than 150 ft.
3) No. 10 AWG for 20A, 120V circuits longer than 70 ft.
4) No. 8 AWG for 20A, 120V circuits longer than 100 ft.

d) When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80 percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.

7) Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.

B. Conductors in Cabinets:

1) Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.

2) Tie and bundle feeder conductors in wireways of panelboards.

3) Hold conductors away from sharp metal edges.

C. Homeruns:

1) Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.

2) MC cable homeruns are not allowed unless indicated on drawings.

D. Exposed cable is not allowed.

E. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.

F. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.

G. Use of MC Cable is limited to the following conditions. Installations that do not comply with the following conditions are to be removed and replaced with no additional expense to the Owner.

1) 15 and 20 amp branch wiring where following conditions apply:

a) Use MC cable for final flexible connections from junction or outlet boxes to recessed fixtures. Do not use MC cables to loop between fixtures, except where it is not practical to provide conduit connections between boxes or where existing inaccessible ceilings prevent installation of conduit runs. Each individual luminaire is to be serviced by an individual cable drop from the associated junction box in the ceiling space. Maximum length 6-feet of MC cable. Luminaire drops secured to, and supported by, the building structure with nylon tie wraps. The use of the ceiling suspension system for support of any type of cabling is not permitted.

b) MC cable may be routed in the void space above hard lid ceilings, and routed within wall cavities below glazing, provided NEC requirements are otherwise met, and a minimum one 0.75-inch conduit is routed from nearest accessible ceiling space to inaccessible location, terminating in a j-box with blank faceplate, for future circuits.

3.4 CONNECTORS

A. Install to assure a solid and safe connection.

B. Select hand twist connectors for wire size and install tightly on conductors.

C. Install compression connectors using methods and tools recommended by the manufacturer.

D. Do not install stranded conductors under screw terminals unless compression lugs are installed.

E. Do not connect wiring without UL listed connectors that are listed for the purposes.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Connectors and Accessories

2) Grounding Conductor

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Test reports of ground resistance for service and separately derived system grounds.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Comply with the requirements of ANSI/NFPA 70.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Connectors and Accessories:

1) Burndy Hyground Compression System

2) Erico/Cadweld

3) Amp Ampact Grounding System

4) Pipe Grounding Clamp:

a) Burndy GAR Series

b) O Z Gedney

c) Thomas & Betts

d) Or approved equivalent.

B. Grounding Conductor

1) General Cable

2) Okonite

3) Southwire

4) Or approved equivalent

2.2 CONNECTORS AND ACCESSORIES

A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.

B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.3 GROUNDING CONDUCTOR

A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than #10 AWG Bare. Solid copper for wire sizes #10 AWG and smaller.

B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify site conditions prior to beginning work.

B. Bond Sections of service equipment enclosure to service ground bus.

C. Separately Derived Systems: Ground each separately derived system per NEC Article 250.

D. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.

E. Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.

F. Resistance of grounding electrode system: measure using a four-terminal fall-of-potential method as defined in IEEE 81. Take ground resistance measurements before electrical distribution system is energized and in normally dry conditions, not less than 48 hours after last rainfall. Take resistance measurements of separate grounding electrode systems before systems are bonded together below grade. Combined resistance of separate systems may be used to meet required resistance, but specified number of electrodes must still be provided.

G. Inspect and test in accordance with NETA Standard ATS, Except Section 4.

H. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.2 CONNECTORS AND ACCESSORIES INSTALLATION

A. Install per manufacturer's instructions.

3.3 GROUNDING CONDUCTOR INSTALLATION

A. Raceways:

1) Ground metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger equipment grounding conductor is included with circuit, use

grounding bushing with lay-in lug.

2) Connect metal raceways, which terminate within an enclosure but without mechanical connection to enclosure, by grounding bushings and ground conductor to grounding bus.

3) Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.

4) Install equipment grounding conductor, code size minimum unless noted on drawings, in metallic and nonmetallic raceway systems.

B. Feeders and Branch Circuits:

1) Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.

2) Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.

C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.

E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Anchors, Threaded Rod and Fasteners

2) Support Channel, Hangers and Supports

3) Rooftop Conduit Supports

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.

2) Support systems to be supplied by a single manufacturer.

3) Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.

a) 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 hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. General: Provide conduit and equipment hangers and supports in accordance with the following:

1) When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.

2) Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of Washington.

1) Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.

2) Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.

D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.

E. Provide seismic restraint hangers and supports for conduit and equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Anchors, Threaded Rod and Fasteners:

1) Anchor It

2) Epcon System

3) Hilti-Hit System

4) Power Fast System

5) Or approved equivalent.

B. Support Channel, Hangers and Supports:

1) B-Line

2) Kindorf

3) Superstrut

4) Unistrut

5) Or approved equivalent.

C. Rooftop Conduit Supports:

1) Cooper B-Line Dura-Block Rooftop Support Base

2) Or approved equivalent.

2.2 ANCHORS, THREADED ROD AND FASTENERS

A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.

C. Anchors and Fasteners:

1) Do not use powder-actuated anchors.

2) Concrete Structural Elements: Use precast inserts.

3) Steel Structural Elements: Use beam clamps.

4) Concrete Surfaces: Use self-drilling anchors.

5) Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.

6) Solid Masonry Walls: Use expansion anchors.

7) Sheet Metal: Use sheet metal screws.

8) Wood Elements: Use wood screws.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

1) Channel Material: Carbon steel.

2) Coating: Hot dip galvanized.

B. Pipe Straps: Two-hole galvanized or malleable iron.

C. Luminaire Chain: 90 lb. test with steel hooks.

D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.

1) Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.4 ROOFTOP CONDUIT SUPPORTS

A. Curb base made of 100 percent recycled rubber and polyurethane prepolymer with a uniform load

B. Capacity of 500 pounds per linear foot of support.

C. UV resistant.

D. Steel Frame: Steel, 14 gauge strut galvanized per ASTM A653 or 12 gauge strut galvanized per ASTM A653 for bridge series.

E. Continuous block channel supports with 1-inch gaps to allow water flow, bridge channel supports, extendable height channel supports and elevated single conduit supports.

F. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633 fastened directly into rubber material with weather resistant Type 12 lag screws.

G. Provide load distribution plates when required for heavy loads.

H. Finish: Black with safety yellow striping.

I. Provide hot dipped galvanized components for items exposed to weather.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Fabrication - Miscellaneous Metals

1) General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

2) Finishes:

a) Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.

b) Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.

c) For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.

B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.

C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

D. Do not use supports or fastening devices to support other than one particular item.

E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

F. Provide seismic bracing per IBC requirements.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. Use spring lock washers under fastener nuts for strut.

I. Cutting and Drilling

1) Do not drill or cut structural members without prior permission from Architect.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.

C. Verify mounting height of luminaires prior to installation when heights are not detailed.

D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.

E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.

F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.

G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.

H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

I. Do not use supports or fastening devices to support other than one particular item.

J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by NEC.

K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by NEC.

L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by NEC.

M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by NEC.

N. Maximum distance between supports for rigid PVC conduits unless otherwise required by NEC is as follows:

1) 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.

2) 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.

3) 2-1/2-inch and 3-inch conduit, 5-feet apart.

4) 4-inch and 5-inch conduit, 6-feet apart.

5) 6-inch conduit, 7-feet apart.

O. Maximum distance between supports for auxiliary gutters and wireways unless otherwise required by NEC is as follows:

1) Sheet metal auxiliary gutters and wireways - 4-feet apart horizontally and 10-feet vertically.

2) Non-metallic auxiliary gutters and wireways - 30-inches apart horizontally and 3-feet vertically.

P. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by NEC.

Q. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Architect for optimal appearance.

R. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

S. Provide seismic bracing per IBC requirements.

T. Where service disconnects are mounted on building exterior, physically attach service disconnect to the building or structure served.

U. Install surface-mounted cabinets and panelboards with minimum of four anchors.

V. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

W. Wet and Damp Locations:

1) In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

3.4 ROOFTOP CONDUIT SUPPORTS INSTALLATION

A. Consult roofing manufacturer for roof membrane compression capacities. If necessary, provide a compatible sheet of roofing material (rubber pad) under rooftop support to disperse concentrated loads and add further membrane protection.

B. Do not use supports that will void roof warranty.

C. Install supports per manufacturer's instructions and recommendations.

D. Use properly sized clamps to suit conduit sizes.

E. Install supports for rooftop raceways to raise raceways a minimum of 7/8-inches above the roof structure unless otherwise noted.

END OF SECTION

SECTION 26 05 33
RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Rigid Metal Conduit (RMC)

2) Electrical Metallic Tubing (EMT)

3) Liquidtight Flexible Metal Conduit (LFMC)

4) Conduit Fittings

B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on Drawings and described in these Specifications.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment

2) Section 26 05 34, Boxes

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Metal Conduit (RMC):

1) Allied Tube & Conduit

2) Beck Manufacturing Inc.

3) Picoma
4) Wheatland Tube Company
5) Or approved equivalent.

B. Electrical Metallic Tubing (EMT):
1) Allied Tube & Conduit
2) Beck Manufacturing WL
3) Picoma
4) Wheatland Tube Company
5) Or approved equivalent.

C. Liquidtight Flexible Metal Conduit (LFMC):
1) AFC Cable Systems Inc.
2) Electri-Flex Company
3) International Metal Hose
4) Or approved equivalent.

D. Conduit Fittings:
1) Bushings:
a) Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:
1) Thomas & Betts 1222 Series
2) O-Z Gedney B Series
3) Or approved Equivalent.
2) Raceway Connectors and Couplings:
a) Thomas & Betts Series
b) O-Z Gedney Series
c) Or approved Equivalent.
3) Expansion/Deflection Fittings:
a) EMT: O-Z Gedney Type TX
b) RMC: O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD
c) PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy OPEJ Series
d) Or approved equivalent.

2.2 RIGID METAL CONDUIT (RMC)

A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
1) Fittings: NEMA FB2.10.

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Description: UL 797, ANSI C80.3; steel galvanized tubing.

B. Fittings: NEMA FB 1; steel, compression type.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.

B. Fittings: NEMA FB 2.20.

2.5 CONDUIT FITTINGS

A. Bushings:

1) Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.

2) Insulated grounding type for threaded raceway connectors.

B. Raceway Connectors and Couplings:

1) Steel connectors, couplings, and conduit bodies, hot-dip galvanized.

2) Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.

3) Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.

4) Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.

5) Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

C. Provide expansion/deflection fittings for EMT.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.

B. Conduit Size:

1) Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.

C. Underground Installations:

1) More than 5-feet from Foundation Wall: Use PVC.

2) Within 5-feet from Foundation Wall: Use PVC coated RMC.

3) In or Under Slab on Grade: Use PVC.

4) Minimum Size: 1-inch.

D. In Slab Above Grade:

1) Use PVC.

2) Maximum Size Conduit in Slab: Contact Structural Engineer for maximum outside diameter of conduit.

E. Provide two pull strings/tapes in empty conduits. Types:

1) Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.

2) Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.

3) If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.

4) Secure pull string/tape at each end.

5) Provide caps on ends of empty conduit to be used in future.

6) Label both ends of empty conduits with location of opposite end.

F. Elbows: Use fiberglass or PVC coated RMC for underground installations.

G. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.

H. Verify that field measurements are as shown on Drawings.

I. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.

J. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:

1) Where shown on the Structural Drawings.

2) As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

K. Verify routing and termination locations of conduit prior to rough-in.

L. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

M. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.

N. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.

O. Install nonmetallic conduit in accordance with manufacturer's instructions.

P. Inserts, anchors and sleeves.

1) Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.

2) Coordinate location of sleeves with consideration for other building systems prior to concrete pour.

Q. Conduit Supports:

1) Arrange supports to prevent misalignment during wiring installation.

2) Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

3) Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.

4) Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

5) Do not attach conduit to ceiling support wires.

R. Flexible metal conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.

S. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.

T. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.

U. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.

V. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.

W. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.

X. Keep emergency system wiring independent of other wiring systems per NEC 700.

Y. Arrange conduit to maintain headroom and present neat appearance.

Z. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.

AA. Exposed conduits are permitted only in following areas:

1) Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.

2) Existing walls that are concrete or block construction.

3) Where specifically noted on Drawings.

4) Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.

BB. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.

CC. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.

DD. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

EE. Maintain adequate clearance between conduit and piping.

FF. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.

GG. Cut conduit square using saw or pipecutter; deburr cut ends.

HH. Bring conduit to shoulder of fittings; fasten securely.

II. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.

JJ. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.

KK. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.

LL. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

MM. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

NN. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.

OO. Feeders: Do not combine or change feeder runs.

PP. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

QQ. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

3.2 RIGID METAL CONDUIT (RMC) INSTALLATION

A. Outdoor Locations Above Grade: RMC.

B. Damp Locations: RMC.

C. In areas exposed to mechanical damage: RMC.

D. For security conduits installed exposed and subject to tampering: RMC.

3.3 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

A. Dry Locations:

1) Concealed: EMT.

2) Exposed: EMT.

B. Dry, Protected: EMT.

3.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.

B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.5 CONDUIT FITTINGS INSTALLATION

A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.

B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.

D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.

E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

F. Use PVC coated, threaded type fittings in corrosive environments.

G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.

H. Condulets and Conduit Bodies:

1) Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.

I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.

J. Expansion Joints:

1) Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, installed per manufacturer's recommendations.

2) Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.

3) Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.

4) Verify expansion/deflection requirements with Structural Engineer prior to installation.

K. Seismic Joints:

1) No conduits cast in concrete allowed to cross seismic joint.

2) Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Architect that 15-inches is adequate for designed movement, and if not, increase this length as required.

3) Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inches and larger may be installed.

L. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION

SECTION 26 05 34
BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Outlet Boxes

2) Pull and Junction Boxes

3) Box Extension Adapter

4) Weatherproof Outlet Boxes

B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Section 26 05 33, Raceways

2) Section 26 05 53, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Outlet Boxes:

1) Hubbell

2) Thomas & Betts

3) Eaton/Crouse-Hinds

4) Or approved equivalent.

B. Pull and Junction Boxes:

1) Eaton/Crouse-Hinds
2) Hoffman
3) Or approved equivalent.

C. Box Extension Adapter:
1) Hubbell
2) Thomas & Betts
3) Eaton/Crouse-Hinds
4) Or approved equivalent.

D. Weatherproof Outlet Boxes:
1) Legrand (Pass & Seymour)
2) Hubbell
3) Thomas & Betts
4) Eaton/Crouse-Hinds
5) Intermatic
6) Or approved equivalent.

2.2 OUTLET BOXES

A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.

B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep for non-USB type devices. Installation of one or two devices at common locations, minimum 4-inches square, minimum 2-inches deep for USB type devices. Single- or two-gang flush device raised covers.

C. Telecom Outlet: Provide 4-inches square, minimum 2-1/8-inch deep box with two-gang plaster ring.

D. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.

E. Masonry Boxes: Outlets in concrete.

F. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. All surface mounted outlet boxes are to be drawn. Welded boxes are not acceptable.

G. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

H. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

2.3 PULL AND JUNCTION BOXES

A. Construction: Provide ANSI 61 gray polyester powder painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and

washers.

B. Location:

1) Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.

2) Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.

C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1) Construction: Galvanized cast iron.

2) Cover: Smooth cover with neoprene gasket and stainless steel cover screws.

3) Cover Legend: ELECTRIC.

D. Fiberglass Handholes: Die molded glass fiber hand holes:

1) Cable Entrance: Pre-cut 6- x 6-inch cable entrance at center bottom of each side.

2) Cover: Fiberglass weatherproof cover with nonskid finish.

3) Cover Legend: ELECTRIC.

2.4 BOX EXTENSION ADAPTER

A. Construction: Diecast aluminum.

B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.5 WEATHERPROOF OUTLET BOXES

A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.

B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.

C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Architectural Elevations.

F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.

1) Adjust box locations up to 10-feet if required to accommodate intended purpose.

G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.

K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.

L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.

M. Install knockout closures in unused box openings.

N. Clean interior of boxes to remove dust, debris, and other material.

O. Clean exposed surfaces and restore finish.

3.2 OUTLET BOXES INSTALLATION

A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:

1) Control Switches:

a) 48-inches to the top of outlet box.

b) 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.

2) Receptacles: 15-inches to the bottom of outlet box.

3) Telecom Outlets: 15-inches to the bottom of outlet box.

4) Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.

D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.

E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.

G. Use flush mounting outlet box in finished areas.

H. Do not install flush mounting box back-to-back in walls; provide minimum 6-inches separation. Provide minimum 24-inches in acoustic rated walls.

I. In acoustical walls, apply acoustic putty pad on outlet box prior to installation of acoustical blanket.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Use stamped steel bridges to fasten flush mounting outlet box between studs.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Use gang box where more than one device is mounted together. Do not use sectional box.

N. Use gang box with plaster ring for single device outlets.

O. Adjust flush-mounting outlets to make front flush with finished wall material.

3.3 PULL AND JUNCTION BOXES INSTALLATION

A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

C. Do not fasten boxes to ceiling support wires.

D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.4 BOX EXTENSION ADAPTER INSTALLATION

A. Match material to box.

B. Install gaskets at exterior and wet locations.

3.5 WEATHERPROOF OUTLET BOXES INSTALLATION

A. Use cast outlet box in exterior locations exposed to weather and wet locations.

B. Install gaskets.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Equipment Nameplates

2) Device Labels

3) Wire Markers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.

2) Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.

3) Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equipment Nameplates:

1) B & I Nameplates

2) Intellicum

3) JBR Associates

4) Or approved equivalent.

B. Device Labels:

1) Kroy
2) Brady
3) Or approved equivalent.

C. Wire Markers:
1) Brady
2) Panduit
3) Sumitomo
4) Or approved equivalent.

2.2 EQUIPMENT NAMEPLATES

A. Engraved phenolic plastic, laminate, minimum 1/16-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification LP-387A. All upper case letters in engraver standard letter style of the size and wording indicated. Provide with 2-mil adhesive backing. Embossed tape style labels are not acceptable.

B. Color:
1) Normal (Utility): White letters on black background.
2) Life Safety/Critical (Emergency Systems): Black letters on orange background.
3) Equipment Branch (Legally Required Standby Systems): Black letters on yellow background.

C. Letter Size:
1) Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, distribution panels, generators, automatic transfer switches, UPS, etc.
2) Use 1/4-inch or 1/2-inch letters minimum for identifying panels, breakers, transformers, VFDs, disconnects, etc.
3) Use 3/16-inch minimum for identifying source, voltage, current, phase, wire configurations, and short circuit current rating (SCCR).

D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.

F. Locations:
1) Switchgear, switchboards, sub-distribution switchboards, distribution panels, branch panels, automatic transfer switches, UPS.
2) Main breakers and distribution breakers in switchgear, switchboards, and distribution panels.
3) Equipment including, but not limited to, motor controllers, disconnects, and VFDs.
4) Low-voltage equipment enclosures including, but not limited to, fire alarm panels, access control panels, and lighting control panels.
5) Distribution transformers.

2.3 DEVICE LABELS

A. Extra strength, laminated adhesive tape with 3/16-inch black letters on clear background. Embossed tape/punch tape style labels are not acceptable.

B. Receptacles: Indicate source panel and source circuits (e.g. xxx-xx).

C. Wall Switches/Control Device Stations:

1) Where controls are provided for remote lighting or power outlets, or where controls in same location serve different purposes or areas, such as corridor and outside, provide device label indicating function of each control device.

2) Label the function of control devices where two or more are mounted in same location and control function may be unclear.

3) Wall switches with engraved buttons do not require labeling.

D. Junction Boxes: Label to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

E. Panel and circuit designation written in permanent marker on the back of the plate and inside all back-boxes and junction boxes.

2.4 WIRE MARKERS

A. Description: Vinyl-cloth self-adhesive type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.

C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.

D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate designations used on Drawings with equipment nameplates and device labels.

B. Install nameplates and labels parallel to equipment lines.

C. Identify empty conduit and boxes with intended use.

D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.

E. Provide color coded boxes as follows:

1) Fire Alarm: Red.

3.2 EQUIPMENT NAMEPLATES

A. Degrease and clean surfaces to receive nameplates.

B. Secure equipment nameplates to equipment front using manufacturer adhesive backing.

C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Verify emergency system distribution equipment nameplate colors with Architect/Owner.

E. Switchgear, switchboards, sub-distribution switchboards, distribution panels and branch panels to include name, source, voltage, current, phase, wire configuration, and short circuit current rating (SCCR). Transformers to include source, KVA, and secondary voltage, phase, and wire configuration.

F. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above. Verify with Architect/Owner if nameplate on outside of door is required.

G. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.

3.3 DEVICE LABELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Degrease and clean surfaces to receive labels. Fingers to be regularly cleaned of grease and debris to prevent fingerprints on labels. Labels installed dirty or with fingerprints to be replaced at no cost to Owner.

3.4 WIRE MARKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide wire markers on each conductor for power, control, signalling and communications circuits.

END OF SECTION

SECTION 26 09 23
OCCUPANCY AND VACANCY SENSORS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Occupancy/Vacancy Sensors (Ceiling Mounted)

2) Combined Occupancy Sensor/Wall Switches ("Sensor/Switches")

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Provide wiring diagrams indicating low voltage and line voltage wiring requirements.

2) Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner.

2) Prepare and complete report of test procedures and results. Submit these test procedures and results to Owner and Architect.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Occupancy/Vacancy Sensors (Ceiling Mounted):

1) Passive Infrared Occupancy/Vacancy Sensors:

a) Steinel

b) Or approved equivalent.

B. Combined Occupancy Sensor/Wall Switches ("Sensor/Switches"):

1) Steinel

2) Or approved equivalent.

C. Basis of Design: Occupancy/Vacancy sensor layout on Drawings are designed based on Steinel product line. Approved manufacturers listed are allowed on condition of meeting the specified conditions including complete sensor coverage of the area controlled and switching of luminaires in the area controlled. Provide additional sensors and power switch packs as needed to provide the same level of functionality as shown on Drawings or required in Specifications. Remove and replace electrical equipment installed not meeting these conditions at no cost to Owner.

2.2 GENERAL

A. Occupancy sensor designation indicates sensors automatically turn lights ON when the sensor detects the presence of a person and will automatically turn lights OFF when no presence is detected for a specified amount of time (automatic-on and automatic-off).

B. Vacancy sensor designation requires someone to manually turn the lights ON. The sensor will then automatically turn the lights OFF when no presence is detected for a specified amount of time (manual-on and automatic-off).

C. Provide occupancy sensors to sense presence of human activity within desired space and enable or disable on/off manual lighting control function provided by local switches.

D. Upon detection of human activity by detector, sensor initiates time delay to maintain lights on for present period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.

E. Factory set sensors for maximum sensitivity.

F. LED lamp built into sensor indicates when occupant is detected.

G. Provide zero cross relay control with sensors and sensor/switched; relay contacts close and open with AC voltage signal is at zero.

H. Where line voltage sensors and sensor/switches are used, provide to match voltage of controlled circuit.

I. Line Voltage Sensors, Control Units, and Relays: UL listed.

2.3 OCCUPANCY/VACANCY SENSORS (CEILING MOUNTED)

A. Passive Infrared Sensors:

1) Sensor Function: Detects human presence in floor area being controlled by detecting changes in Infrared energy. Sensor detects small movements, i.e., when people are writing while seated at a desk.

2) Provide temperature compensated dual element pyro-electric sensor and with multi element Fresnel lens.

3) Provide daylight filter to ensure that sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by sun.

4) Sensor utilizes advanced digital signal processing technology to reduce false offs without reducing sensitivity.

5) Sensor utilizes DIP switches for adjustment to time delay and override. Field adjustable settings for sensitivity.

6) Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel to allow coverage of large areas.

7) Provide adjustments and mounting hardware under removable cover to prevent tampering.

8) Finish: White.

9) Ceiling-Mounted Sensor:

a) Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).

b) 360 degree sensor range; Coverage: 1,200-square feet, unless otherwise noted on Drawings.

c) Provide internal form C dry contacts for HVAC control.

B. Ultrasonic Occupancy/Vacancy Sensors:

1) Sensor Function: Detects human presence in controlled floor area by detecting Doppler shifts in 40kHz ultrasound created by sensor.

2) Sensors are precision crystal controlled and do not interfere with each other when two or more are placed in same area. Sensor includes advanced digital signal processing to reduce false on signals without decreasing sensitivity, as well as immunity to RFI/EMI sources.

3) Sensor utilizes DIP switches for adjustment to time delay and override. Field adjustable settings for sensitivity.

4) Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel to allow coverage of large areas.

5) Provide adjustments and mounting hardware under removable cover to prevent tampering.

6) Finish: White.

7) Ceiling-Mounted Sensor:

a) Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).

b) Maximum protrusion of 1.1-inches and blend in aesthetically with ceiling.

c) 360 degree sensor range; Coverage: 2,000-square feet, unless otherwise noted on Drawings.

d) Provide internal form C dry contacts for HVAC control.

8) Ceiling Mounted Sensor - Hallway Sensor Coverage:

a) Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).

b) Maximum protrusion of 1.5-inches and blend in aesthetically with ceiling.

c) Coverage: 90 linear feet.

d) Provide internal form C dry contacts for HVAC control.

C. Dual Technology Sensors:

1) Sensor Function: Combined capability of passive infrared with ultrasonic or microphonic technology as described above. Upon a person entering a space, motion must be sensed by both technologies before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on. Sensors retrigger time delay where only one motion is necessary to turn on lights within 5 seconds after turning off.

2) Sensor utilizes DIP switches for adjustment to time delay and override. Field adjustable settings for sensitivity.

3) Low Voltage Sensor: 24VDC power. Sensor operates remote power switch packs. Multiple sensors can be wired in parallel to allow coverage of large areas.

4) Ceiling-Mounted Sensor:

a) Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).

b) 360 degree sensor range; Coverage: 1,000-square feet for half-step motion, unless otherwise noted on Drawings.

c) Provide internal form C dry contacts for HVAC control.

2.4 COMBINED OCCUPANCY SENSOR/WALL SWITCHES ("SENSOR/SWITCHES")

A. Completely self-contained sensor system that fits into standard single gang box. Internal transformer power supply, latching dry contact relay switching mechanism compatible with LED drivers, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.

B. Passive infrared sensor technology includes advanced signal processing to reduce false triggers without increasing sensitivity. LED indicator blinks when occupant sensed.

C. Rated to switch loads: 1000 watts at 120-volt; 1200 watts at 277 volt. Zero-crossing technology switches lighting off when AC voltage is at zero, minimizes contact wear.

D. Adjustable high-end and low-end trim setting.

E. Provide adjustable daylight feature that holds lighting "off" when desired footcandle level is present.

F. Provide integral off override switch with no leakage current to load or ground.

G. Vandal-resistant lens.

H. Includes neutral wire to meet NEC.

I. Finish: White.

J. Alerts for impending shut-off: light flash, audible, both or none.

K. Standard Sensor/Switch:

1) Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off). Factory set to manual on/auto off.

2) 180 degree sensor range; Coverage: 180-square feet for desktop activity.

L. Dual Relay Sensor/Switch:

1) Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).

2) Dual auto-off buttons on face of switch allow end-user to turn off two switch legs in room space. Built-in light adjustable level sensor only turns off second of two relays when desired footcandle level is present. Otherwise similar to specifications above for single-zone sensor/switch.

3) Defaults to Manual-ON to 50 percent operation for maximum energy savings.

4) 180 degree sensor range; Coverage: 150-square feet for desktop activity.

5) Finish: White.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install occupancy/vacancy sensors as directed by manufacturer's instructions. Complete connections to control circuits, occupancy sensors, power supply pack and low voltage wiring.

B. Provide power packs for sensor to control number of circuits and/or switch legs within its area of coverage.

C. Field adjust each sensor to maximize its coverage of room space.

D. Relocate sensors with ultrasonic technology to avoid being closer to HVAC diffusers and power packs than recommended by manufacturer.

E. Coordinate HVAC control requirements with controls contractor prior to installation.

F. Lighting System Testing and Commissioning:

1) Test lighting controls to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with Drawings and Specifications. Provide functional testing of sequences of operation to ensure operation in accordance with Drawings and Specifications. Provide complete report of test procedures and results to engineer and insert approved copy into project closeout documents.

2) Testing includes:

a) Occupant Sensing Automatic Controls.

b) Automatic Time and Override Controls for Interior Lighting.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Panelboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Section 26 28 00, Overcurrent Protective Devices.

2) Section 26 43 00, Surge Protective Devices

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) UL 67, Standards for Panelboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Product Data: For each type of panelboard, overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

2) Shop Drawings: For each panelboard and related equipment.

a) Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1) Enclosure types and details for types other than NEMA 250, Type 1.
2) Bus configuration, current, and voltage ratings.
3) Short-circuit current rating of panelboards and overcurrent protective devices.
4) Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

b) Wiring Diagrams: Power, signal, and control wiring.

3) Operation and Maintenance Manuals:

a) After completion of work and start-up of the equipment at the project site, deliver to the Owner's Authorized Representative operation instructions, maintenance manuals and drawings presenting full details for care and maintenance of each type of equipment provided under this Contract. Number of copies in accordance with Division 01.

b) Each copy to contain the operating and maintenance information and parts lists for equipment provided under this Contract. When necessary, provide supplemental drawings to show system operation and servicing maintenance points. For electrical components, provide wiring and connection diagrams. Include instructions required to accomplish specified operation and functions. Data to be neat, clean and legible.

c) Panelboard drawings and wiring diagrams to be included and up to date at the completion of start-up and system acceptance by the Owner. Drawings and wiring diagrams to include any field modifications or changes to reflect actual as-installed conditions.

d) In general, the manual to include, but not necessarily be limited to, the following:

1) Panelboard Elevation and One Line.
2) AC and DC Schematic and Physical Component Layout Drawings.
3) Remote Interface Drawing.
4) Bill of Material.
5) Description of Operation.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panelboards:

1) Eaton

2) Basis of Design: Schneider Electric/Square D

3) Or approved equivalent.

B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, and amps interrupting capacity (AIC). Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.2 PANELBOARDS

A. Description: Panelboards 400 amps or less. NEMA PB1, Type 1 or as indicated on drawings, circuit breaker type. Maximum enclosure depth: 6-inches for surface mounted, 5-3/4-inches for flush mounted.

B. Maximum Width: 20-inches.

C. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electrical utility.

D. Panelboard Bus Non-Reduced: Copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in

each panelboard.

E. Lugs: Mechanical type for both aluminum and copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating.

F. Provide double lugs and/or feed-through lugs for feed through feeders.

G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for poles; UL listed. Predrill bus for bolt-on breakers.

1) Type SWD for lighting circuits.

2) Type HACR for air conditioning equipment circuits.

3) Class A ground fault interrupter circuit breakers where scheduled.

4) Class B ground fault equipment protection circuit breakers for heat trace and other circuits as required by Code. Provide shunt trip circuit breakers where scheduled; provide wiring to remote trip switch/contacts as indicated on Drawings.

5) Do not use tandem circuit breakers.

H. Accessories: Provide where indicated: shunt trip, arc-fault circuit interrupter (AFCI), Class A ground fault circuit interrupter (GFCI), auxiliary switch, and alarm switch.

I. Cabinet Front: Provide flush or surface mounting as shown on the schedules, drawings, or otherwise noted. Cabinet front with concealed hinged front cover construction, metal directory frame with heavy clear plastic protector, flush lift latch and lock, two keys per panel all keyed alike.

J. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.

K. Furnish surface mounted cabinet boxes without knockouts.

L. Surge Protective Device: Provide for emergency distribution systems equipment as required per NEC Article 700.8.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturer's installation instructions.

B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Owner designated room names and numbers, and not designations shown on drawings.

F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.

G. Provide arc flash labels.

H. Provide concrete housekeeping pad for floor-mounted distribution panelboards. Extend 6-inches beyond distribution panel width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.

I. Provide two 1-inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.

J. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit breaker pole position.

K. Ground and bond panelboard enclosure per NEC.

L. Paint:

1) Standard factory finish unless noted otherwise.

2) Panelboards located in finished interior areas in view of building occupants; paint to match adjacent wall surface. Color and paint preparation as specified by Architect. Covers to be painted off wall, then installed over dried, painted wall surface.

M. Provide handle guards on each circuit supplying obviously constant loads such as fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.

N. Provide interior wiring diagram, neutral wiring diagram, UL label, and short circuit rating on interior or in booklet format inserted in sleeve inside panel cover.

O. Verify available recessing depth and coordinate wall framing with other divisions.

P. Maintain fire rating of wall where panels are installed flush in fire rated walls.

Q. Perform inspections and tests in accordance with manufacturer's requirements.

R. Thoroughly clean exterior and interior of each panelboard in accordance with manufacturer's installation instructions.

S. Vacuum construction dust, dirt, and debris out of each panelboard.

T. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

3.2 PANELBOARDS INSTALLATION

A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.

B. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.

C. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provision of materials, installation and testing of:

1) Wall Switches

2) Receptacles

3) Finish Plates

4) Surface Covers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Wall switches

2) Receptacles

3) Wall Plates

4) In-Use Cover

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Switches:

1) Toggle Type:

a) Cooper AH1201

b) Hubbell HBL1221

c) Leviton 1221

d) Legrand P&S PS20AC1

e) Or approved equivalent.

B. Receptacles:
   1) Industrial Grade - 20 Amp:
      a) Cooper 5362
      b) Hubbell HBL5362
      c) Bryant BRY5362
      d) Leviton 5362
      e) Legrand P&S 5362A
      f) Or approved equivalent.
   2) Ground Fault Circuit Interrupter (GFCI) Receptacle - 20 Amp:
      a) Cooper WRSGF20W
      b) Hubbell GFR5362SGW
      c) Legrand P&S 2097TRWR
      d) Or approved equivalent.

C. Finish Plates:
   1) Bryant
   2) Cooper
   3) Hubbell
   4) Leviton
   5) Legrand P&S
   6) Or approved equivalent.

D. Surface Covers:
   1) Aluminum with Gasket, Blanks, Single Gang:
      a) Bell 240-ALF
      b) Carlon
      c) Or approved equivalent.
   2) 2-Gang:
      a) Bell 236-ALF
      b) Carlon
      c) Or approved equivalent.
   3) While-in-Use Weatherproof Cover:
      a) Die Cast Cover:

1) Intermatic
2) Hubbell
3) Cooper
4) Or approved equivalent.

E. Provide lighting switches and receptacles of common manufacturer and appearance.

2.2 WALL SWITCHES

A. Characteristics: Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage, extra heavy duty.

B. Finish: White.

2.3 RECEPTACLES

A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.

1) Commercial Grade: Riveted. Back and side wired. Brass ground contact on steel strap. Nylon face and nylon base. 20 amp.

B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.

C. Special Purpose Receptacles: Reference Drawings for NEMA Standard Specification.

D. Finish:

1) Same exposed finish as switches.

2) Receptacles installed in surface raceway to match raceway finish. See Section 26 05 33, Raceways.

3) All automatically controlled, nonlocking type, 125 volt, 15 amp and 20 amp rated receptacles to be permanently marked by the manufacturer with the "universal power" symbol and the word "controlled."

2.4 FINISH PLATES

A. Finish Plates: Type 302 stainless steel with smooth satin finish.

B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.5 SURFACE COVERS

A. Material: Galvanized steel, drawn, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.

B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.

C. While-in-Use Weatherproof Cover: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.

1) Die cast cover with closed cell neoprene foam gasket: Capable of being locked closed to prevent tampering or unauthorized use.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Architect immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts

are resolved.

B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Owner.

C. Orientation:

1) Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.

2) Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Architect.

3) Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Architect.

D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.

E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.2 WALL SWITCHES INSTALLATION

A. At time of substantial completion, replace those items which have been damaged.

3.3 RECEPTACLES INSTALLATION

A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.

B. In the following outlet locations, regardless of whether shown as GFCI on Drawings, either provide a GFCI duplex receptacle, or use a GFCI breaker where code would require a GFCI outlet to have a remote test switch:

1) Bathrooms.

2) Where receptacles are installed within 6-feet, 0-inches from edge of sinks.

3) Kitchens above counters.

4) On rooftops.

5) Outdoors.

6) Where serving vending machines.

7) Where serving electric drinking fountains.

C. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.

3.4 FINISH PLATES INSTALLATION

A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

3.5 SURFACE COVERS INSTALLATION

A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION

SECTION 26 28 00
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Fuses

2) Molded Case Circuit Breakers

3) Fuse Cabinets

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.

2) Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fuses:

1) Bussmann

2) Ferraz-Shawmut

3) Littelfuse

4) McGraw-Edison

5) Or approved equivalent.

B. Molded Case Circuit Breakers:

1) Eaton Electrical

2) ABB/General Electric

3) Siemens
4) Schneider Electric/Square D
5) Or approved equivalent.

C. Fuse Cabinet:
1) Bussmann
2) Circle AW
3) Ferraz-Shawmut
4) Littelfuse
5) Siemens
6) Schneider Electric/Square D
7) Or approved equivalent.

2.2 FUSES

A. Characteristics:
1) Dual element, time delay, current limiting, nonrenewable type, rejection feature.
2) Combination Loads: UL Class RK1, RK5, or J, 1/10 to 600 amp. UL Class L, above 600 amps.
3) Motor Loads: UL Class RK5, 1/10 to 600 amp.
4) Fuse pullers for complete range of fuses.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.

B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

C. Calibrate for operation in 40 degrees C ambient temperature.

D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

G. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per NEC Article 240.87(B).

H. Provide ground fault protection for breakers 1000 amps and greater where applied at 480 volts line-to-line and where indicated on Drawings. Provide ground fault annunciation in lieu of protection, where required, for breakers on emergency (NEC 700) and legally required (NEC 701) systems.

2.4 FUSE CABINET

A. Enclosure:
1) Metallic cabinet surface mounted, with internal shelves, trim cover with hinged and latched door.

2) Size cabinet such that spare fuses required by these Documents do not exceed 50 percent of cabinet volume.

B. Label: Provide engraved label to identify as spare fuse cabinet.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination:

1) Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.

2) Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.

B. Install all items in accordance with manufacturers written instructions.

3.2 FUSES INSTALLATION

A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:

1) 0 to 24: Provide 6 spare.

2) 25 to 48: Provide 9 spare.

3) 49 and Above: Provide 12 spare.

3.3 MOLDED CASE CIRCUIT BREAKERS INSTALLATION

A. Provide testing of ground fault interrupting breakers.

B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.

C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.

D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

3.4 FUSE CABINETS INSTALLATION

A. Install fuse cabinet on wall in the Electrical Room in coordination with electrical equipment.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Safety Switches

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1) Section 26 24 16, Panelboards.

2) Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Safety Switches:

1) Eaton Electrical

2) ABB/General Electric

3) Siemens

4) Schneider Electric/Square D

5) Or approved equivalent.

2.2 SAFETY SWITCHES

A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.

B. Clearly marked for maximum voltage, current, and horsepower.

C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.

D. Switches rated for maximum available fault current.

E. Handle lockable in 'off' position.

F. Enclosure:

1) NEMA 1: Dry locations/Indoors.

2) NEMA 3R: Damp or wet locations/Outdoors.

G. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R or J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse Clips: Designed to accommodate Class L fuses. Provide with shunt-trip and ground fault capabilities. Remove if circuit breaker type is used.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.

B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating

C. Install in accordance with manufacturer's instructions.

D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.

E. Provide arc flash labels.

F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 SAFETY SWITCHES

A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.

B. See General Installation Requirements above.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) SPD for Distribution Panels - Nonmodular Type

B. Supply and install the Surge Protective Devices (SPD) having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

C. SPDs: Integral to panelboards and switchboards, installed by the manufacturer. Field installed equipment not permissible.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Listed per UL 1449, third edition, and complimentary listed per UL 1283 as FRI/EMI filter.

2) Comply with ANSI/IEEE C62.45 test procedures for Category-C3 established in C62.41.2 and CSA certified (C22.2).

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Related SPD Specifications, Drawings, maintenance manuals, installation instructions, and UL 1449, third edition, listed surge suppression ratings of specified protection modes.

2) Project Record Documents: Record actual locations of SPDs.

3) Maintenance Data:

a) Include module replacement instructions.

b) Include maintenance and troubleshooting instructions for electronic components.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Manufacturer's Qualifications: ISO 9001 certification SPD manufacturers complete quality control and documentation procedures of firms regularly engaged in manufacture of SPD product for Category-C3 (ANSI/IEEEC62.41.2) and whose product has been of satisfactory service for not less than 5 years.

a) Provide local support for SPD.

b) Provide both service entrance and distribution panel SPD of same manufacturer.

2) Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Advanced Protection Technologies, Inc. (APT)

B. Current Technology

C. Eaton Electrical

D. Lea International

E. Liebert

F. Schneider Electric/Square D

G. Surge Suppression Inc. (SSI)

H. Siemens

I. Or approved equivalent.

2.2 SPD FOR DISTRIBUTION PANELS - NONMODULAR TYPE

A. List SPD in accordance with UL 1449 (third edition), Standard for Safety, Surge Protective Devices, and UL 1283, Electromagnetic Interference Filters.

B. Independently test SPD with Category-C3 high exposure waveform (20KV - 1.2/50 µs, 10 kA - 8/20 µs) per ANSI/IEEE C62.41.2 (2002)

C. Provide SPD with copper bus bars for surge current path. Small gauge round wiring, plug-in type connections, or printed circuit boards not be used in path for surge current diversion. Equally distribute surge current to MOV components to ensure equal stressing and maximum performance. Surge suppression platform must provide equal impedance paths to each matched MOV.

D. Use no plug in component modules or printed circuit boards as surge current conductors. Hardwire internal components with connections utilizing low impedance conductors and compression fittings.

E. In order to isolate SPD under any fault condition, manufacturer to provide:

1) Individually fuse the MOV via copper fuse. Copper fuse provides protection during high (ka) surge events.

2) Equip MOVs with thermal fuse which allows disconnection of suppression component at overheating stage common during TOV.

3) Test overcurrent protection components in compliance with UL 1449 (3rd Edition) Limited Current Test and AIC rating test.

F. Equip SPD with an audible alarm that activates when one of surge current modules have failed. Provide an alarm on/off switch to silence alarm. Provide an alarm push-to-test switch to test the alarm. Locate switches and alarm on the front cover of the SPD's enclosure.

G. Provide SPD that Meet or Exceed the Following Criteria:

1) Provide maximum single impulse current rating at no less than 100 kA per phase. Manufacturers must provide documented proof of independent third party verification of single impulse current withstand capabilities.

2) Pulse Life Test: Capable of protecting against and surviving 2000 ANSI/IEEE C62.41.2 Category-C3 transients without failure or degradation of UL 1449 (third edition) clamp voltage by more than 10 percent.

3) UL 1449 (third edition) clamping voltage not to exceed the following:

VOLTAGE	L-G	L-N	N-G
208Y/120V	800V	800V	800V
480Y/277V	1200V	1200V	1200V

4) Nominal discharge current of 20KA I (n).

H. Make SPD of solid-state components which operate bidirectionally.

I. Provide SPD with response time no greater than five nanoseconds for individual protection modes.

1) SPD designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.

2) Provide visible indication of proper SPD connection and operation. Provide 10 year warranty, incorporating unlimited replacements of SPD if they are destroyed by transients within warranty period.

J. Provide SPD designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.

1) Provide terminals for necessary power and ground connections.

2) Provide SPD with minimum EFI/RFI filtering of 30dB at 100KHZ with an insertion loss ratio of 316:1 using Military Standard 220A methodology.

3) Provide SPD with 10 year warranty, incorporating unlimited replacement parts if they are destroyed by transients during warranty period.

PART 3 - EXECUTION

3.1 SPD FOR DISTRIBUTION PANELS - NONMODULAR TYPE INSTALLATION

A. Install one secondary SPD at each distribution panel location as indicated on Drawings. SPD unit to be integral to panelboard.

END OF SECTION

SECTION 26 51 00
LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1) Luminaires

2) LED Drivers

3) Lamps

B. Provide wiring for complete and operating lighting system.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) NECA 500 - Commercial Lighting.

2) UL 8750 - Light Emitting Diode (LED) equipment for use in lighting products.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) Submit product data for:

a) LED Luminaires: Electrical ratings, dimensions, mounting, material, clearances, terminations, wiring, connection diagram, LM-79 photometric data, LM-80 lumen depreciation data.

b) LED Drivers

c) Lamps

2) Submittal Cutsheets: Highlight, circle or otherwise graphically indicate which option(s) are being selected for the products submitted. Cutsheets that are not edited to indicate which products and options are submitted for this project or that list only catalog numbers to identify submitted options are not acceptable.

3) Specified manufacturers are approved to submit bid. However, inclusion does not relieve manufacturer from supplying product as described.

4) Provide the following operating and maintenance instructions as required by Section 26 00 00, Electrical Basic Requirements:

a) Luminaires

b) LED Drivers

c) Lamps

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1) Provide luminaires acceptable to code authority for application and location installed.

2) Comply with applicable ANSI standards.

3) Comply with applicable NEMA standards.

4) Provide luminaires and lampholders that comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the AHJ (e.g., UL, ETL, and the like).

5) Comply with NEC as applicable to installation and construction of luminaires.

6) Comply with fallout and retention requirements of IBC for diffusers, baffles, and louvers.

7) Provide LED luminaires from the same manufacturer and manufacturing LED source batch for similar applications (e.g., all LED downlights from a single manufacturer and batch, all linear LED products from single manufacturer and batch).

1.6 WARRANTY

A. Warranty as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1) LED Luminaire Manufacturer's Warranty: Not less than 5 years for luminaire based on date of substantial completion. Includes normal cost of labor to replace luminaire. Replacement luminaire will match physical dimensions, physical appearance, chromaticity, lumen output and photometric characteristics of original installed equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Luminaires:

1) Reference description and manufacturers in Luminaire Schedule on Drawings.

2) Or approved equivalent.

B. LED Drivers:

1) Indoor Drivers:

a) eldoLED Series

b) Advance/Philips

c) Osram Sylvania

d) Or approved equivalent.

2) Outdoor Drivers:

a) Advance/Philips

b) Osram Sylvania

c) LG

d) Or approved equivalent.

C. Lamps:

1) LED (Light Emitting Diode) Lamps:

a) Nichia

b) Cree

c) Osram Sylvania

d) GE Lumination

e) Or approved equivalent.

2) Unless specific manufacturer not shown on this list is indicated in the Luminaire Schedule.

3) Special types as indicated in Luminaire Schedule.

4) Or approved equivalent.

2.2 LUMINAIRES

A. Luminaires: Reference description and manufacturers in Luminaire Schedule on Drawings.

B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.

C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet location.

D. Suspended luminaires: Provide minimum 24-inch adjustability in aircraft cable length where used.

E. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material. Verify with Architectural Reflected Ceiling Plan prior to submittals.

F. Finishes:

1) Manufacturer's standard finish (unless otherwise indicated) over corrosion resistant primer.

2) Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectance.

3) Exterior Finishes: As detailed in Luminaire Schedule or on Drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.

G. Light Transmitting Components:

1) Plastic diffusers, molded or extruded of 100 percent virgin acrylic.

2) Prismatic acrylic, extruded, flat diffusers, 0.125-inch overall thickness, unless otherwise noted.

H. LED Luminaires:

1) UL listing of luminaire includes drivers, transformers, enclosures, rated wire, communications devices and accessories needed for a complete and functional system.

2) LM-79: Testing and measurement of absolute photometry, chromaticity (CCT) and luminaire power. Report provided by DOE certified independent testing laboratory. CCT as specified in Luminaire Schedule.

3) Standards: ANSI C78.377, LM-79 and LM-82 compliant for performance characteristics, photometry, colorimetry, efficacy and thermal characteristics.

4) LM-80 + TM-21: Testing and measurement, and statistical prediction of LED lamp life. Report provided by DOE certified independent testing laboratory.

5) LEDs in one module/luminaire: Supplied from same batch/bin and fall within 3-step MacAdam Ellipse, or as described in Luminaire Schedule, whichever is the more stringent requirement.

6) Provide luminaires with integral LED thermal management system (heat sinking).

7) Luminaires to be equipped with an LED driver that accepts 120V through 277V, 50Hz to 60Hz (universal). Component-to-component wiring within the luminaire will carry no more than 80 percent of rated current and be listed by UL for use at 600VAC at 302 degrees F/150 degrees C or higher. Plug disconnects to be listed by UL for use at 600VAC, 15A or higher.

8) Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire.

2.3 LED DRIVERS

A. General:

1) Performance: Meet dimming range called out in Luminaire Schedule, free from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

2) Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

3) Minimum efficiency of 85 percent, power factor greater than or equal to 0.90, compliance with reduction of hazardous substances (RoHS). Rated for operating temperature range of area in which driver is installed.

4) Limit inrush current to minimize breaker tripping.

a) Base specification: NEMA 410 standard for inrush current for electronic drivers.

b) Preferred Specification: Meet or exceed 30 milliamp-squared-seconds at 277VAC for up to 50 watts of load and 75 amps at 240 microseconds at 277VAC for 100 watts of load.

5) Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

6) No visible change in light output with a variation of plus/minus 10 percent line voltage input.

7) Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD at no point in the dimming curve allows imbalance current to exceed full output THD.

8) Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:

a) Adjustment of forward LED voltage, supporting 3V through 55V.

b) Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA.

c) Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

9) Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.

10) UL Recognized under the component program and modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

11) Ability to provide no light output when the analog control signal drops below 0.3 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control dead band between 0.3V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.

B. Light Quality:

1) Over the entire range of available drive currents, driver to provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 percent to 1 percent light output and step to 0 percent where indicated. Driver to respond similarly when raising from 0 percent to 100 percent.

a) Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.

2) Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.

3) Drivers to track evenly across multiple luminaires at all light levels, and must have an input signal to output light level that allows smooth adjustment over the entire dimming range.

4) Driver and luminaire electronics to deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100 percent to 0.1 percent luminaire will have:

a) LED dimming driver to provide continuous step-free, flicker free dimming similar to incandescent source.

b) Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.

c) Preferred specification: Flicker index to be equal to incandescent, less than 1 percent at all frequencies below 1000 Hz.

C. Control Input:

1) Provide control protocol to match lighting control system specified for use with luminaire.

2) 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:

a) Meet IEC 60929 Annex E for General White Lighting LED drivers.

b) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.

c) Meet ESTA E1.3 for RGBW LED drivers.

2.4 LAMPS

A. Provide lamps for luminaires.

B. Provide lamp catalogued for specified luminaire type.

C. Incandescent Lamps: Not allowed unless noted in Luminaire Schedule.

D. LED (Light Emitting Diode):

1) LED manufacturer will include, but not be limited to, light source, luminaire, power supply and control interface with added components as needed for complete and functioning system.

a) Comply with ANSI chromaticity standard for classifications of color temperature. See Luminaire Schedule for specified LED lamp color and color temperature. UL or ETL listed and labeled.

b) Luminaire testing per IESNA LM-79 and LM-80 procedures.

c) Lamp life for white LEDs: 50,000 plus hours with lamp failure occurring when LED produces 70 percent of initial rated lumens.

d) Lamp life for color LEDs: 30,000 plus hours with lamp failure occurring when LED produces 50 percent of its initial rated lumens.

e) LED Drivers: Reverse polarity protection, open circuit protection, require no minimum load. Minimum 80 percent efficiency. Class A noise rating.

f) Dimming: LED system capable of full and continuous dimming.

g) Correlated Color Temperature (CCT): See Luminaire Schedule for selection of color temperature for each luminaire. Ranges given below reflect maximum allowable tolerances for color temperature range for each nominal CCT.

1) Nominal CCT:
(a) 2700 K (2725 ± 145)
(b) 3000 K (3045 ± 175)
(c) 3500 K (3465 ± 245)
(d) 4000 K (3985 ± 275)

h) Color Rendering Index (CRI) to be greater than or equal to 80.

2) Special types as indicated in Luminaire Schedule.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written installation instructions and requirements.

B. Install luminaires securely, in neat and workmanlike manner.

C. Install luminaires of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.

D. Wiring:

1) Recessed luminaires to be installed using flexible metallic conduit or MC Cable as allowed by Section 26 05 19 with luminaire conductors spliced to branch circuit conductors in nearby accessible junction box over ceiling. Junction box fastened to building structural member within 6-feet of luminaire.

2) Luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.

3) Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.

4) Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.

E. Relamp luminaires which have failed lamps at substantial completion.

F. Replace LED drivers deemed as excessively noisy by Architect, Engineer, or Owner.

G. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

H. Support luminaires larger than 2- by 4-foot size independent of ceiling framing.

I. Locate recessed ceiling luminaires as indicated on architectural reflected ceiling plan.

J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

K. Exposed Grid Ceilings:

1) Support surface mounted luminaires in grid ceiling directly from building structure.

2) Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.

3) Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

L. Install recessed luminaires to permit removal from below.

M. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

N. Install clips to secure recessed grid-supported luminaires in place.

O. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Architectural Drawings.

P. Install accessories furnished with each luminaire.

Q. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

R. Bond products and metal accessories to branch circuit equipment grounding conductor.

S. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

T. Where manufactured wiring assemblies are used, ensure that wiring assembly manufacturer sends components to appropriate luminaire manufacturer for respective installation of proper components.

U. Coordination:

1) Coordination of Conditions: Coordinate ceiling construction, recessing depth and other construction details prior to ordering luminaires for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment. Where luminaires supplied do not match ceiling construction, replace luminaires at no cost to Owner.

2) Electrical drawings are schematic, identifying quantity and type of luminaires used and their approximate location, but are not to be used for dimensional purposes. Reference architectural drawings for exact locations, including mounting heights.

3) Provide lighting indicated on Drawings with luminaire of the type designated and appropriate for location.

4) Provide LED luminaires with driver compatible to lighting control system as shown in drawings and as specified.

5) Where remote drivers are required, ensure adequate accessibility to driver. Upsize conductors between luminaire and driver to accommodate voltage drop.

V. Field Quality Control:

1) Perform field inspection in accordance with Division 01, General Requirements.

2) Operate each luminaire after installation and connection. Inspect for proper connection and operation.

W. Cleaning:

1) Clean electrical parts to remove conductive and deleterious materials.

2) Remove dirt and debris from enclosures.

3) Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.

4) Clean photometric control surfaces as recommended by manufacturer.

5) Clean finishes and touch up damaged finishes per by manufacturer's instructions.

X. Demonstrate luminaire operation for minimum of two hours.

3.2 LUMINAIRES

A. Install per manufacturer's written installation instructions and requirements.

B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.

C. Avoid interference with and provide clearance from equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.

D. Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.

E. Emergency Egress Luminaires: Provide unswitched circuit for battery charging and autotransfer circuiting for exit signs and luminaires with integral batteries. Where test switch cannot be integral to luminaire, mount remote test switch flush-to-ceiling and adjacent to egress luminaire.

F. Interior Luminaire Supports:

1) Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.

2) Maintain luminaire positions after cleaning and relamping.

3) Support luminaires without causing ceiling or partition to deflect.

4) Provide mounting supports for recessed and pendant mounted luminaires as required by IBC.

G. Adjusting:

1) Aim and adjust luminaires as indicated.

2) Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.

3) Align luminaires that are not straight and parallel/perpendicular to structure.

4) Position exit sign directional arrows as indicated.

3.3 LED DRIVERS

A. Install lamps per manufacturer's installation instructions and requirements.

B. Where driver is remote mounted, size wiring based on type of driver, driver distance from luminaire, and voltage/power level, and manufacturer's installation instructions.

C. Protect 0-10V input from line voltage mis-connection, and so it will be immune and the output unresponsive to induced AC voltage on the control leads.

END OF SECTION